JOHN PORT SPENCER ACADEMY

Engineering Technical

Curriculum Overview

Key Stage – KS5

Joy Progress Success Act with care, kindness, respect and integrity

Our curriculum is carefully sequenced to ensure cumulative knowledge and progression. Each unit builds on the last, with clear concepts that students must grasp to progress. We define end points to illustrate what mastery looks like by year-end.

Location of resources:	
Curriculum intent and rationale:	***The engineering & technology curriculum develops students who are not just a generation of hobbyists but are work ready members of society who possess a comprehensive knowledge, understanding and skills set to resiliently tackle everyday design problems.*** ***They are able to create innovative and high-quality solutions that strive to make life better in an increasingly technological world.*** Students are taught in mixed ability groups, with a total of 10 lessons per week. Students follow the OCR Cambridge Technical Engineering Diploma specification: https://www.ocr.org.uk/Images/253338-science-for-engineering.pdf The rationale for teaching OCR Level 3 Cambridge Technical Diploma in Engineering is that it equips learners with practical, industry-relevant skills and knowledge essential for careers in engineering. It blends theoretical understanding with hands-on experience, fostering problem-solving, design, and analytical thinking. The course supports progression to university, apprenticeships, or employment, offering flexible pathways in mechanical, electrical, and control engineering. Developed with input from employers and higher education, it ensures alignment with real-world demands. Its applied learning approach, including project-based assessments and employer engagement, prepares students for the workplace.
National Curriculum Links:	**N/A at KS5**

What content needs to be covered? Key Knowledge and skills / misconceptions to address (with vocab in bold and spelling underlined)
By the end of the course students will know:

Yr 12 Half Term 1	Yr 12 Half Term 2	Yr 12 Half Term 3	Yr 12 Half Term 4	Yr 12 Half Term 5	Yr 12 Half Term 6
Students will learn key knowledge and skills about: **Unit 1** Quadratics Logarithms Natural Logarithms Arcs and Radians Arcs Sectors and Circles Right Angled Triangles Non Right Angled Triangles Sine and Cosine Operations Coordinate Geometry Graphical Transforms Differentiation Differentiation Max Min Differentiation Trig Differentiation Logs Integration Integration Trig Definite Integrals Mean Median Mode Range Representing Data Standard Deviation Probability **Unit 19** - How inspection and testing methods are used to minimise quality issues - Production Parts Approval Process (PPAP) - First Off and Last Off inspection (FOLO) - Statistical Process Control (SPC) - How SPC moving range charts are produced and used	**Students will learn key knowledge and skills about:** **Unit 2** Errors Force Vectors SUVAT Mass Density Centre of Mass Moments Energy and Power Material Properties Hookes Law Youngs Modulus **Unit 19** - Non-destructive testing methods: • visual • dye penetration testing • magnetic particle inspection • ultrasonic flaw detection • radiography X-ray • eddy current and electro-magnetic testing - Which type of material or component each non-destructive testing method is suitable for - The advantages and limitations of each non-destructive testing method - Automatic inspection techniques: • robotics • computer vision • optical inspection • Co-ordinate Measuring Machine (CMM)	**Students will learn key knowledge and skills about:** **Unit 2** Charge and Current Ohms Law Series and Parallel Resistors Power and Efficiency Resistivity Capacitance Inductance Drift Velocity Pressure Viscosity Energy Flow Gas Laws Combined Gas Law Thermal Physics **Unit 10** - How to use advanced solid modelling tools: • surface modelling: o surface construction geometry o extruded, revolved, swept and lofted/blended surfaces o boundary surfaces, planar/flat or filled surfaces o advanced curve geometry - Aspects of assembly: • multiple component assemblies • exploded views • animation • how to apply constraints or mates - How to use formats and templates:	**Students will learn key knowledge and skills about:** **Unit 3** SUVAT Projectiles Energy and Power Momentum Friction Moments Shear Force Stress Irregular Shapes Centroids **Unit 10** - Types of simulation: • motion o movement of assemblies o collision detection o gears, drives, motors or pulleys - Manufacturability: • draft analysis • mould flow • tooling production • shrinkage allowance • machining simulation • jig and fixture development - Finite Element Analysis (FEA): • pressure testing • loads/forces applied to components • torsional testing of components • meshing of geometry - Computational Fluid Dynamics (CFD): • mould flow • material flow	**Students will learn key knowledge and skills about:** **Unit 17** - Advantages of using computers in manufacturing - Manual CNC programming: • part programming o CNC coding o G & M codes o co-ordinates - X, Y, Z o tooling – positions, directions, types and selection o speed and feed rates o tool changing o how to perform on-screen simulation o adjustment of machine settings through the manipulation of manual programming techniques and program code o mathematical calculation - Use of CAM software: • how to use 3D CAD geometry in a CAD system • how to export and import data in appropriate formats • analysis using CAM software - Production and manufacture of parts: • production planning • download files to machine • set tooling • load program	**Students will learn key knowledge and skills about:** **Unit 3** Beams Bending Moments Levers and Gears Gear Systems Belts and Pulleys **Unit 17** - Machine set-up: • datums • jigs, fixtures, clamps • setting tooling - Machine operations: • roughing and finishing operations • tool changing • operations list - Machining of components: • cycle time • inspection: o measurement o check against specification o adjust program based on observations - Rapid prototyping - 3D printing using additive manufacturing techniques: • Fused Deposition Modelling (FDM) • Selective Laser Sintering (SLS) • Stereolithography (SLA) • Electron Beam Freeform Fabrication (EBF)

- How to schedule inspection and testing methods and processes to improve quality control
- The types of defects that can occur in materials, their causes and effects:
  - cracking
  - lamination
  - segregation
  - shrinkage
  - porosity
  - inclusions
- The type of defects that occur in different manufacturing processes:
  - forging
  - casting
  - welds
  - coatings
- In-service defects that can occur in different manufactured components:
  - types
  - causes and effects
  - relationship with material and manufacturing process defects
- Destructive testing methods:
  - Charpy Notch test
  - tensile testing
  - Vickers, Rockell and Brinnel – hardness testing
- Which type of material or component each destructive testing method is suitable for
- The advantages and limitations of each destructive testing method

Unit 10

- How to use solid modelling tools to produce 3D models:
  - sketch-based feature -sketch tools:
    - o lines, arcs, splines, polygons
    - o extrudes, revolves
    - o sizing and dimensioning
    - o applied features - fillets, chamfers, shelling, holes, drafts
    - reference geometry - work planes, axes, points, co-ordinate systems

Challenge:
All pupils are challenged to complete the Distinction tasks in the coursework units.
Pupils are challenged to give detailed and justified responses to all criteria.
Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence.

- How automatic inspection techniques are used in quality assurance in manufacturing
- The advantages and limitations of automatic inspection techniques
- Types of automatic testing techniques used in manufacturing - Automated Test Equipment (ATE)
- How automatic testing techniques are used in manufacturing:
  - scope of use
  - speed
  - limitations and advantages
  - what is being detected
  - protocols and systems
  - setting up

Unit 10

- How to use solid modelling tools to produce 3D models:
  - sketch-based feature-sketch tools:
    - o pattern features - mirror, linear and circular arrays/patterns
- How to use advanced solid modelling tools:
  - features:
    - o swept features
    - o lofted/blended features
    - o variable section features
    - o helical sweeps
    - o sheet metal
  - projected or intersection geometry:
    - o projected curves
  - table driven features

Unit 6

- Circuit schematic diagram drawing using CAD software:
  - schematic capture / schematic design
  - component library
  - connection or interconnection
  - grid
- Circuit simulation and test using CAD software:
  - design checking, design rule checking
  - SPICE (Simulation Program with Integrated Circuit Emphasis)
  - setting and adjusting component parameters
  - netlist/node list
  - circuit analysis using virtual instruments

Students will recap, retrieve and build on key knowledge and skills:
Lessons each week are dedicated to Unit 1 recap / retrieval ready for the early January exam entry.
Retrieve knowledge linked to 2D and 3D CAD tools as they are applied to make 3D parts.

  - border templates
  - formats
  - standards
  - critical information
- How to use projection and units:
  - first and third angle projection
  - section views
  - detailed views
  - isometric views
  - scale
- how to apply dimensioning and annotations
- Assembly drawings:
  - tables and balloons:
    - o Bill of Materials (BOM)
    - o parts lists
    - o exploded views
- Drawing standards
- Types of simulation:
  - motion
    - o movement of assemblies
    - o collision detection
    - o gears, drives, motors or pulleys
- Manufacturability:
  - draft analysis
  - mould flow
  - tooling production
  - shrinkage allowance
  - machining simulation
  - jig and fixture development
- Finite Element Analysis (FEA):
  - pressure testing
  - loads/forces applied to components
  - torsional testing of components
  - meshing of geometry
- Computational Fluid Dynamics (CFD):
  - mould flow
  - material flow
  - thermal conductivity
  - fluid flow
  - aerodynamic efficiency

Unit 6

- Printed circuit board (PCB) layout production to include both track and component views:
  - parts and component libraries
  - manual component placement
  - automatic component placement
  - manual and automatic routing of PCB tracks
  - correct track and pad sizing
  - requirements for double-sided or multiple circuit boards
  - design constraints
  - incorporation of test points or test indicators
  - inclusion of mounting holes
  - inclusion of component and pin identification
  - export files
  - bill of material (BOM) production

  - thermal conductivity
  - fluid flow
  - aerodynamic efficiency

Unit 6

- Application of discrete, through hole and surface mount component types
- Benefits and drawbacks to the manufacturer of using surface mount components and using alternatives
- Applications and reasons for using multiple layer PCBs
- Manufacturing processes used within commercial circuit construction - flow solder process, pick and place, manual component placement
- Quality assurance methods used during commercial printed circuit board (PCB) production - automatic test, visual inspection

Unit 17

- Use of computers in additive and subtractive manufacturing processes
- CNC setting, operating, programming:
  - machine structures
    - o 3, 4, 5 axis
    - o milling
    - o turning
    - o machining centres
    - o welding fabrication machines
- Automation in manufacturing:
  - robotics
  - systems and control - PLC programming
- Computer aided planning:
  - resource management
  - production planning
  - data and database management - automated ordering systems & production and supplier management

Students will recap, retrieve and build on key knowledge and skills:
Lessons each week are dedicated to Unit 2 recap / retrieval ready for the June exam entry.
Recall of circuit population and manufacturing techniques
Recall of testing methods to fault find circuits

Challenge:
All pupils are challenged to complete the Distinction tasks in the coursework units.
Pupils are challenged to give detailed and justified responses to all criteria.
Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence.

Misconceptions:

  - start cycle and run program

Students will recap, retrieve and build on key knowledge and skills:
Lessons each week are dedicated to Unit 2 recap / retrieval ready for the June exam entry.
Retrieval of 3D CAD skills from Unit 10 to accurately create 3D parts / drawings

Challenge:
All pupils are challenged to complete the Distinction tasks in the coursework units.
Pupils are challenged to give detailed and justified responses to all criteria.
Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence.

Misconceptions:
Unit 17
Assuming CAM Software Automatically Optimizes Toolpaths
G&M codes are the same thing

- How additive manufacturing techniques are used:
  - for the production of final components
  - in advanced applications
- Production of 3D components using additive manufacturing
- Production of 3D CAD data and conversion to STL file format

Students will recap, retrieve and build on key knowledge and skills:
Lessons each week are dedicated to Unit 3 recap / retrieval ready for September.

Challenge:
All pupils are challenged to complete the Distinction tasks in the coursework units.
Pupils are challenged to give detailed and justified responses to all criteria.
Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence.

Misconceptions:
Unit 3
Confusing Stress and Pressure
Misinterpreting Force Diagrams
Assuming All Beams Behave the Same
Misapplying Gear Ratios

Unit 17
Thinking Additive Manufacturing Is Just 3D Printing

Misconceptions: **Unit 1** Misquoting or Misusing the Quadratic Formula Confusion Between Factorisation and Algebraic Division Incorrect Use of Logarithmic Laws Misunderstanding Simultaneous Equations **Unit 19** Confusing Destructive and Non-Destructive Testing Assuming All Materials React the Same in Tests Misunderstanding the Causes of Defects Not Differentiating Between In-Service and Manufacturing Defects **Unit 10** Confusing 2D and 3D CAD Tools	**Challenge:** All pupils are challenged to complete the Distinction tasks in the coursework units. Pupils are challenged to give detailed and justified responses to all criteria. Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence. **Misconceptions:** **Unit 2** Confusing Scalar and Vector Quantities Misunderstanding SI Units and Prefixes Confusion Between Elastic and Plastic Deformation Confusing Gauge and Absolute Pressure Overlooking the Role of Efficiency **Unit 19** Thinking Automatic Testing Is Always Better Confusing Destructive and Non-Destructive Testing **Unit 6** Confusing Schematic Design with PCB Layout Misunderstanding Simulation Tools Incorrect Component Placement	- Safe manufacture of PCBs using surface etching - Circuit construction following circuit diagram(s) - Safe circuit construction using appropriate methods - component assembly, PCB soldering techniques, use of appropriate hand tools - Correct order for circuit construction - use of integrated circuit holders - Visual inspection techniques for testing electronic circuits: • fitting of incorrect components • mis-placed components • dry joints • bridged or damaged PCB tracks - Appropriate testing and fault-finding techniques - continuity testing, test-point voltage, current measurement, signal tracing - Use of physical test equipment - power supplies, multi-meter, logic probe, oscilloscope, signal generator - Techniques for design verification through comparison with simulation data - Fault rectification **Students will recap, retrieve and build on key knowledge and skills:** Students to recap / retrieve prior unit 2 knowledge from HT2, as well as applying it to past paper questions. Retrieve knowledge linked to 2D and 3D CAD tools as they are applied surface modelling tasks (D1) **Challenge:** All pupils are challenged to complete the Distinction tasks in the coursework units. Pupils are challenged to give detailed and justified responses to all criteria. Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence. **Misconceptions:** **Unit 10** Incorrect Use of Constraints in Assemblies Misinterpreting Simulation Tools Misapplying Dimensioning and Annotation **Unit 6** Misapplying Fault-Finding Techniques	**Unit 6** Confusing Surface Mount and Through-Hole Components Misunderstanding Quality Assurance in Commercial Manufacture **Unit 17** Confusing CAD with CAM Assuming CNC Machines Are Fully Automated		
Yr 13 Half Term 1	**Yr 13 Half Term 2**	**Yr 13 Half Term 3**	**Yr 13 Half Term 4**	**Yr 13 Half Term 5**	
Students will learn key knowledge and skills about: **Unit 4** Resistance Kirchoffs Laws Logic Gates Boolean Logic Latches and Flip Flops	**Students will learn key knowledge and skills about:** **Unit 4** Phasor Diagrams Motors Generators	**Students will learn key knowledge and skills about:** **Unit 13** - How to use measuring equipment: • rule • vernier calipers • micrometer	**Students will learn key knowledge and skills about:** **Unit 9** - Techniques to create freehand 2D and 3D drawings and sketches, and the application of rendering techniques: • use of drawing pens, pencils, and markers	**Final preparations of coursework units for submission week 2**	

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Op Amps Non Inverting Op Amps Inverting Op Amps Summing Amps and Schmitts AC Power AC to DC Rectification Sine Wave RL and RC Circuits RLC Circuits **Unit 16** - Basic architectures of devices: • Programmable Interface Controllers (PICs) • microprocessor • microcontroller - Use of logical instructions in programming - Conversion of high level programming languages to machine code and then to binary/hexadecimal - Boolean algebra in logic programming - How to use flow charts to map logic flow - How to use subroutines in programs - How to use comments for maintenance and debugging - How embedded devices differ from microprocessors - Practical applications for embedded devices - How to apply programming technique for an embedded device including the testing and validation of programs - The structure of ladder logic: • inputs/outputs • counters and timers • subroutines • latching operations • how to construct ladder diagrams to achieve control functions • how to configure program logic to achieve Boolean operations - How to load and operate PLC programs - How to use simulation software to model, test and validate PLC programs - Limitations of software validation - Structured approaches to testing of software in order to minimise defects (bugs) - The four accepted levels of testing • unit testing • integration testing • system testing • acceptance testing - Acceptance testing for software systems: • Alpha testing • Beta testing - Metrics used to assess quality of software **Unit 18** - Lean principles: • specify 'value' in the eyes of the end user • map the value stream	**Unit 13** - How to apply safe working procedures in a mechanical operations environment: • observance of safety notices and codes of conduct • how to produce and use safe work method statements for performing mechanical operations • how to carry out risk assessments for mechanical operations • the appropriate use and storage of Personal Protective Equipment (PPE) • disposal of waste - How to correctly interpret engineering drawings for manufacture using first and third angle orthographic projections: • types of line, dimensions, annotations - How to create a production plan using method statements - How to use bench tools: • use of marking tools and equipment: o surface gauge and height gauge o surface plate o vee blocks o angle plates o scribe o centre punch and dot punch o odd leg calipers o dividers o engineer's square o combination set o engineer's blue • use of hacksaw and junior hacksaw and the importance of tooth size • use of flat, half round, round, square and three square files • filing techniques - cross-filing and draw filing • use of vice clamps • use of hand taps and dies • use of tapping and clearance drills - How to use bench processes: • how to write a Standard Operating Procedure for assembly • how and where to use a range of temporary fastenings: o nuts o bolts o self-tapping screws o machine screws • correct assembly procedures: o torque settings o sequence of tightening o thread locking - How to perform manually controlled machining operations on the centre lathe: • speeds and feeds for common metals	• combination set and engineer's square - How to apply planned quality control checks: • checking against drawings • identifying important dimensions • tolerances • concentricity • surface finish • visual inspection • random sampling **Unit 9** - How to investigate the use of materials in existing products and components: • safe product disassembly • safe testing • internet research - How to determine material requirements for a new design scenario - requirements, frequency of use, maintenance and cost factors, tolerances - How to select the most suitable materials to satisfy a material specification: • using appropriate material databases and resources • using appropriate material selection charts - consideration of the properties of materials and key factors in their selection - How to justify material selection in design solutions: • materials' properties • methods of processing and finishing • availability and sustainability • forms of supply and relative cost • fitness for the intended purpose - How to investigate the different manufacturing methods used in existing products and components: • safe product disassembly • safe testing • internet research **Unit 18** - Production planning: • operations and processes • time • materials • tools • machinery - Influencing factors: • scales of production • machine capacity • operation or process limitations - Planning to include lean and quality - Manipulation of takt time and cycle time - Use of JIT and Kanban - Implementation of quality and inspection techniques - Automated and manual processes - Factory or production layout - Minimising the lean wastes	• use of perspective views • use of 'thick and thin line' technique • use of rendering to show light source, shading, colour and surface texture • layout and presentation of freehand design sketches - Hand-drawing techniques to create formal 2D and 3D engineering drawings complete with parts and assemblies: • use of drawing pens and pencils • use of drawing instruments • use of templates, stencils and radius aids • formal drawing layout and presentation skills - Application of drawing, sketching and rendering skills in the creation and development of designs for engineering products or components: • use of freehand sketching in the generation of a range of design ideas and variations • use of rendering techniques to improve the visualisation of design possibilities in real-life • use of formal drawings to communicate design solutions with technical detail - The principles of Design for Manufacture and Assembly (DFMA). in manufacturing processes, - The limiting factors in manufacturing processes and their impact when applying DFMA: • material choice • dimensional tolerances • further processes required such as finishing • alternative manufacturing processes - How to design a component or product applying knowledge of manufacturing and materials and DFMA principles: • use of common parts across components and products • design simplification • design for ease of assembly of parts • compatibility of materials and processes • detailing of correct tolerances and surface finish • 'Sustainable Design' - The practical application of design optimisation: • operational performance and efficiency • weight and economy of materials • quality • manufacturability • efficiency of manufacture/assembly/installation time		

• make the product flow • let the customer pull the product • strive for perfection - Lean wastes: • Transport • Inventory • Movement • Waiting • Overproduction • Overprocessing • Defects • (8th waste) – Skills • Muda, Muri, Mura - Lean tools and techniques: • 5S • Kaizen • Kanban • heijunka • value stream mapping • takt time • just in time (JIT) • production planning • make to order (MTO) or make to replenish (MTR) **Students will recap, retrieve and build on key knowledge and skills:** Lessons each week are dedicated to Unit 3 recap / retrieval ready for the early January exam entry. Recall circuit simulation methods from Unit 6 **Challenge:** All pupils are challenged to complete the Distinction tasks in the coursework units. Pupils are challenged to give detailed and justified responses to all criteria. Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence. **Misconceptions:** **Unit 4** Confusing Current, Voltage, and Charge Misapplying Ohm's Law Incorrect Use of Measuring Instruments Confusion Between AC and DC Incorrect Application of Kirchhoff's Laws **Unit 16** Confusing Microcontrollers with Microprocessors Misunderstanding Ladder Logic Structure Confusing High-Level and Low-Level Languages Overlooking Alpha vs Beta Testing Differences **Unit 18** Misidentifying the Seven Wastes (TIMWOOD) Assuming Lean Tools Work in Isolation Confusing Lean with Cost-Cutting	• turning operations on the lathe, including facing, parallel turning, grooving, taper turning, knurling, external screw cutting and drilling - How to perform manually controlled machining operations on milling and drilling machines: • speeds and feeds for common metals • milling in vertical or horizontal milling machines • correct work holding using clamps and vices • use of dividing head and rotary table • use of pitch circle diameter **Unit 18** - Quality control - Quality assurance - Total quality management - Measuring performance improvements: • interpretation of SPC data - Identification of lean wastes in manufacturing situations **Students will recap, retrieve and build on key knowledge and skills:** Lessons each week are dedicated to Unit 3 & 4 recap / retrieval ready for the early January exam entry. Recall knowledge of feeds and speeds from Unit 17 **Challenge:** All pupils are challenged to complete the Distinction tasks in the coursework units. Pupils are challenged to give detailed and justified responses to all criteria. Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence. **Misconceptions:** **Unit 13** Misunderstanding Feed and Speed Calculations Incorrect Lathe Operations Confusing Bench Tools and Processes	- Cellular and linear production **Students will recap, retrieve and build on key knowledge and skills:** Lessons each week are dedicated to Unit 3 & 4 recap / retrieval ready for the early January exam entry. Recall knowledge of materials and properties from Unit 19 **Challenge:** All pupils are challenged to complete the Distinction tasks in the coursework units. Pupils are challenged to give detailed and justified responses to all criteria. Pupils are challenged with additional examination unit questions, where they are to apply knowledge with independence. **Misconceptions:** **Unit 18** Assuming All Layouts Are Lean	• sustainability/environmental aspects/life cycle costs • marketability • serviceability - Key aspects of an optimum design solution: • design constraints • design variables • design objectives - The use of statistics and mathematical calculations in the optimisation of designs **Unit 18** - Identification of lean wastes in manufacturing situations - Suggested improvements to a manufacturing process: • implementation of lean tools • quality improvement strategies - Industrial best practice - Measuring performance improvements: • improvements in cycle time • reduction in takt time • removal of defects • productivity improvement **Students will recap, retrieve and build on key knowledge and skills:** Retrieve knowledge linked to 2D and 3D CAD tools as they are applied to make 3D part. Those considering re-sitting the examinations will be required to recall knowledge from prior examined units. **Challenge:** All pupils are challenged to complete the Distinction tasks in the coursework units. Pupils are challenged to give detailed and justified responses to all criteria. **Misconceptions:** **Unit 9** Overlooking the Importance of Tolerances Confusing Material Properties Confusing First and Third Angle Projection		

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Key Stage – KS5

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Our curriculum is carefully sequenced to ensure cumulative knowledge and progression. Each unit builds on the last, with clear

Previous learning that is particularly relevant:

GCSE Mathematics: Algebra, geometry, trigonometry, and basic statistics are foundational for engineering calculations.

GCSE Physics: Concepts like forces, energy, electricity, and materials science are directly applicable.

Depending on pathways / options taken at KS4:
Design and Technology
Understanding of materials, manufacturing processes, and technical drawing.
Experience with CAD software or manual drawing techniques.
ICT
Familiarity with **software tools**, **data handling**, and **basic programming** can be useful, especially in units 6, 16 and 17.

Engineering Manufacture
Materials, manufacturing processes
Experience with CAD software
Experience with using manual lathes, 3D printing, laser cutting

Programmable Systems
Logic Gates, Circuit components, Ohms / Power Laws, Series & Parallel Resistors, PCB design, development & manufacture, Test equipment

Future Learning - How content prepares students for future units, Key Stage 4, or Key Stage 5?

The OCR Level 3 Cambridge Technical Diploma in Engineering supports future learning by providing a strong foundation in both academic and practical aspects of engineering.

Preparation for Higher Education
The course includes units aligned with university-level engineering content, such as mathematics, design, and systems control.
It develops research, analytical, and report-writing skills essential for success in degree-level study.

Pathway to Apprenticeships
The practical, hands-on nature of the course mirrors the structure of many advanced and higher apprenticeships.
Learners gain experience with industry-standard tools and processes, making them work-ready.

Development of Transferable Skills
Skills such as problem-solving, teamwork, communication, and project management are embedded throughout the course.
These are valuable in any further learning or professional context.

Flexible Learning Routes
The qualification supports progression into a wide range of engineering disciplines, including mechanical, electrical, civil, and aerospace engineering.
It also allows for lateral movement into related STEM fields.

Outcomes:

By the end of the course, pupils will be able to solve/create/produce/write:

- Solve complex engineering problems using mathematical and scientific principles.
- Create engineering solutions through design, modelling, and prototyping.
- Produce technical drawings, project plans, and engineered components using industry-standard tools and techniques.
- Write clear, structured reports, risk assessments, and evaluations that reflect professional engineering standards.

Assessment Strategy

How we know our students are knowing and remembering more –
Data from hunting not fishing, formative and summative assessment/s is used to adapt teaching and provide targeted challenge and intervention, supporting SEND and disadvantaged pupils.

Formative:

Continuous Feedback
Teachers regularly assess students' work through observations, draft submissions, and informal questioning.
Feedback is given to help learners improve their understanding, refine their technical skills, and correct misconceptions before final assessments.
Skill Development
Formative assessment helps identify gaps in knowledge and skills early, allowing targeted support and intervention.
It encourages learners to reflect on their progress and take responsibility for their learning.
Progress Monitoring
Teachers use formative assessment to track student progress over time, adjusting teaching strategies and resources to meet individual needs.
It informs planning and differentiation, ensuring all learners are challenged appropriately.
Encouraging Dialogue
Peer and self-assessment activities promote discussion, critical thinking, and collaborative learning.
Students learn to evaluate their own work and that of others using engineering criteria and terminology.

Summative (& cumulative)

Summative Assessment
Summative assessments occur at the end of each unit and are used to evaluate a learner's overall understanding and competence.
These include externally assessed exams and internally assessed coursework, such as project portfolios, technical reports, and practical tasks.
They provide a final grade for each unit, contributing to the overall qualification outcome.
Cumulative Assessment
The course structure allows knowledge and skills to build progressively across units.
Learners revisit and apply earlier learning in later units, especially in project-based work and synoptic assessments, which require integration of multiple concepts.
This approach reinforces long-term retention and deeper understanding.
Purpose and Impact
These assessments help identify strengths and areas for improvement, guiding future learning.
They also prepare students for the demands of higher education and employment by simulating real-world engineering tasks and expectations.

Opportunities to revisit past learning:

Spiral Curriculum Design
Many units build on foundational knowledge introduced earlier in the course, such as applying core engineering principles in later design or project units.
This allows learners to revisit and deepen their understanding of key concepts over time.
Synoptic Assessment
Some units require students to draw on knowledge and skills from multiple previous units, encouraging integration and application of learning in new contexts.
Project-Based Learning
Learners often refer back to earlier work, calculations, or designs when developing more complex projects, promoting reflection and iterative improvement.
Formative Feedback and Drafting
Through feedback cycles, students are encouraged to revise and improve their work, reinforcing earlier learning and correcting misconceptions.
Review Activities and Recaps
Teachers use quizzes, revision tasks, and recap sessions to help students consolidate knowledge from earlier in the course.

Opportunities for homework (including apps):
Google Classroom is used extensively throughout the course to support both examined and coursework units.

How is the curriculum adapted to meet the needs of SEND and disadvantaged pupils, while maintaining high expectations?

Wider Curriculum and Enrichment – cultural capital and real world application -

Enriching experiences:

Industry Engagement
Guest speakers and employer-led projects expose students to current industry practices and expectations.
Practical and Project-Based Learning
Learners work on real-life engineering challenges, often simulating workplace scenarios.
Opportunities to design, build, and test prototypes foster creativity and innovation.
These experiences build confidence and allow students to showcase their skills.
Progression and Career Preparation
Work experience placements and university taster sessions help students prepare for their next steps.

Our curriculum supports the school value of:

Joy	*Foster enthusiasm and engagement by offering hands-on, practical learning that connects directly to real-world technology. Tasks are based on authentic scenarios, encouraging creativity, problem-solving, and innovation. The course suits different learning styles through a mix of theory and applied activities, keeping learners motivated. Collaboration and reflection boost participation, while clear links to careers and progression pathways help students see the value of their work. This dynamic approach inspires curiosity and empowers learners with purpose.*
Progress	*We monitor and support progress through a combination of formative and summative assessment strategies. Teachers track student progress through regular practical tasks and written assessments aligned with the assessment objectives of each of the 12 units. Feedback is provided through peer critiques, teacher marking, and one-to-one discussions, helping students reflect and improve. Progress in the Non-Exam Assessment (NEA) is monitored through milestone check-ins and portfolio reviews. Differentiated support,*

Literacy, Oracy and disciplinary language:

Literacy
Students engage in technical report writing, evaluations, and project documentation, which enhances their ability to write clearly, concisely and formally.
They interpret and produce technical texts, such as specifications, manuals, and standards, building subject-specific reading comprehension.

Oracy
Learners participate in presentations, group discussions, and project reviews, developing confidence in speaking and listening.
They explain engineering concepts, justify design decisions, and respond to feedback, which strengthens their verbal communication skills.

Disciplinary Language
The course embeds engineering-specific terminology, encouraging accurate use of technical vocabulary in both written and spoken contexts.
Students learn to articulate complex ideas using the language of the discipline, such as terms related to forces, materials, systems, and processes.

Cross-Curricular opportunities / Opportunities to develop 'character':

Mathematics
Students apply algebra, trigonometry, and calculus in solving engineering problems.
They interpret data, use formulae, and perform calculations related to forces, energy, and materials.
Science (Physics and Chemistry)
Engineering principles are grounded in physics concepts like motion, electricity, and thermodynamics.
Materials science links to chemistry, especially in understanding properties and reactions of metals and polymers.
Information Technology and Computing
Learners use CAD software, simulation tools, and programming (e.g., PLCs or microcontrollers).
Data analysis and digital modelling support both design and testing processes.
English and Communication
Report writing, presentations, and technical documentation develop literacy and oracy.
Students learn to communicate complex ideas clearly and professionally.
Geography and Environmental Science
Topics like sustainable engineering and environmental impact assessments link to global issues.
Design and Technology
Strong overlap in design thinking, prototyping, and evaluating products.
Encourages creativity alongside technical precision.

Our curriculum supports personal development by:

Confidence and Independence
Learners take ownership of projects, make decisions, and solve problems independently, building self-assurance and resilience.
Critical Thinking and Problem Solving
The curriculum encourages analytical thinking, innovation, and the ability to evaluate solutions—skills essential for lifelong learning and adaptability.
Teamwork and Collaboration
Group tasks and project work develop interpersonal skills, cooperation, and the ability to work effectively in diverse teams.
Communication Skills
Through presentations, technical writing, and discussions, students improve their ability to express ideas clearly and professionally.
Responsibility and Professionalism
Learners engage with real-world scenarios, deadlines, and industry expectations, promoting a strong work ethic and accountability.
Awareness of Global and Ethical Issues
Topics such as sustainability, health and safety, and ethical engineering practices encourage learners to consider their impact on society and the environment.

	including scaffolding, modelling, and targeted intervention, ensures all learners can succeed. Digital tools like CAD software and online portfolios also help track development and showcase learning over time.
Success	*We celebrate success by giving verbal praise, positive phone calls, reward points and showcasing exceptional performance – such as practical work, NEA content or written pieces.*
Act with care, kindness, respect, and integrity	*We build meaningful connections with our students starting with hands-on learning that empowers students to create real products. Teachers celebrate individual progress, offer personalised feedback, and tailor instruction to different learning styles. Linking projects to real-world industries and careers helps students see relevance and value.* *Regular check-ins and reflection foster confidence and resilience. By creating a supportive, inclusive environment where every contribution matters, we help students feel seen, heard, and motivated—making engineering not just a subject, but a personal journey of growth and discovery.*

Careers / Employability skills:
How does the curriculum link to the following employability skills:

Listening –
Encouraging students to follow verbal instructions, engage in group discussions, respond to feedback, and absorb information from industry professionals—developing attentive, respectful, and purposeful communication skills essential for employment.
Speaking –
Supports speaking by encouraging students to present ideas, explain technical concepts, and justify design decisions. Through group work, discussions, and project reviews, learners build confidence, clarity, and professionalism in verbal communication.
Problem solving –
Supports problem solving by challenging students to analyse real-world engineering issues, apply technical knowledge, and develop creative, practical solutions. Projects and assessments encourage critical thinking, innovation, and iterative improvement—key skills for employability.
Aiming high –
Supports the employability skill of aiming high by encouraging students to set ambitious goals, take ownership of challenging projects, and strive for excellence in technical tasks. It promotes resilience, self-motivation, and continuous improvement.
Critical thinking –
Supports critical thinking by challenging students to analyse problems, evaluate data, and make informed decisions. Learners assess design options, justify solutions, and reflect on outcomes—developing logical reasoning and evidence-based decision-making essential for engineering careers.
Staying positive –
Supports the employability skill of staying positive by encouraging resilience through challenging projects, problem-solving tasks, and iterative design processes. Learners build confidence by overcoming setbacks, learning from feedback, and celebrating progress.
Leadership –
Supports the employability skill of leadership by encouraging students to take initiative in group projects, delegate tasks, and guide peers through problem-solving processes. It fosters responsibility, decision-making, and confidence in leading technical work.
Teamwork –
Supports the employability skill of teamwork by involving students in collaborative projects where they must share responsibilities, communicate effectively, and solve problems together (unit 18). It builds cooperation, respect, and the ability to work towards common goals.
Creativity –
Supports the employability skill of creativity by encouraging students to design innovative solutions, develop prototypes, and explore alternative approaches to engineering problems. It fosters imaginative thinking through project work and real-world challenges.

Employment Sectors discussed include:
Electrical and Electronic Engineering
Focuses on circuit design, electrical systems, and electronic devices.
Prepares learners for roles in power generation, electronics manufacturing, and telecommunications.
Mechanical Engineering and Design
Covers mechanical systems, materials science, and CAD.
Leads to careers in automotive, aerospace, and product design industries.
Automation, Systems, and Control
Involves robotics, control systems, and programmable logic controllers (PLCs).

		Relevant to sectors like manufacturing automation, smart technologies, and industrial control. **Manufacturing Engineering** Emphasises lean production, quality control, and process optimisation. Supports careers in advanced manufacturing, production planning, and operations management.

Curriculum impact is evaluated through pupil study, work scrutiny, and progress data. Findings inform regular curriculum review to ensure continuous improvement.

When was this curriculum last reviewed? Include date	What changes were made and why?	How is ongoing improvement ensured?
July 25		Work scrutiny, QA monitoring, Learning Walks, CPD sessions
		Faculty meetings, examination reports, recall of exam scripts
		NEA and Mock moderation