

## What are the aims and intentions of this curriculum?

The OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Engineering (Certificate and Extended Certificate) is designed for students aged 16 to 19 who are interested in pursuing a career or further study in the engineering sector. This qualification helps learners develop a solid foundation in engineering principles, problem-solving, and technical knowledge, with a focus on real-world applications. It supports progression to undergraduate engineering courses, higher apprenticeships, or direct employment within the industry. Students will gain practical and theoretical skills through a combination of project-based learning, industry-relevant scenarios, and hands-on experience, ensuring they are well-equipped for the demands of the modern engineering workplace. Available in two sizes; the Certificate (equivalent to half an A Level) and the Extended Certificate (equivalent to one A Level). This qualification can be taken alongside other A Levels or vocational qualifications, offering flexibility in a student's study programme.

Overall, the Cambridge Advanced National in Engineering is ideal for learners who want a focused, technical education with clear pathways to further study or a professional career in engineering.

| Term            | Topics                                                                                  | Knowledge and key terms                                                                                                                                                                                                                                                                                                                          | Skills developed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Assessment                       |
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| <b>Autumn 1</b> | Unit F130:<br>Principles of<br>engineering<br><b>Topic area 1</b><br><b>Mathematics</b> | <p>This unit is assessed by an exam.</p> <p>In this unit you will learn about the mathematical techniques widely used in the engineering industry.</p> <p><b>Topic</b></p> <ul style="list-style-type: none"> <li>• Application of Système International (SI) Units</li> <li>• Mensuration</li> <li>• Algebra</li> <li>• Trigonometry</li> </ul> | <p>Students will develop an understanding of:</p> <ul style="list-style-type: none"> <li>• The relevance of Base SI Units to engineering</li> </ul> <p>principles:</p> <ul style="list-style-type: none"> <li>• Deriving SI units for the subject of an equation</li> <li>• Engineering notation and its relationship to SI prefixes</li> <li>• Scientific notation</li> <li>• The use of scientific and engineering notation</li> </ul> <p>in calculations on a scientific calculator</p> <ul style="list-style-type: none"> <li>• Converting between metric units of Measure</li> <li>• Calculation of perimeter and area of regular and compound 2D shapes</li> <li>• Calculation of surface areas and volumes of regular and compound 3D solids.</li> <li>• Calculations involving mass, density and volume</li> </ul> | Internal and external assessment |

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|                 |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• Rearranging given mechanical engineering formulae and electrical/electronic formulae</li> <li>• Common factors for simple factorization</li> <li>• Solving pairs of simultaneous linear equations with two unknowns using an algebraic method.</li> <li>• Trigonometric ratios</li> <li>• Periodic properties of the trigonometric Functions</li> <li>• Pythagoras' rule</li> <li>• Radian unit of measure</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                   |
| <b>Autumn 2</b> | Unit F130: Principles of engineering<br><b>Topic area 2 Mechanical principles</b> | <p>This unit is assessed by an exam.</p> <p>In this unit you will learn about the forces widely used in the engineering industry.</p> <p><b>Topics:</b></p> <ul style="list-style-type: none"> <li>• Systems of forces</li> <li>• Forces</li> <li>• Moments</li> <li>• Systems of coplanar concurrent forces</li> <li>• Systems of coplanar non-concurrent forces in equilibrium</li> <li>• Shear loading of engineering components</li> <li>• Stress vs strain graphs</li> <li>• Simply supported beams</li> <li>• Forces acting on beams</li> <li>• Beam calculations</li> </ul> | <p>In Topic Area 2 of Unit F130, Principles of Engineering, students delve into Mechanical Principles, focusing on the fundamental concepts that underpin mechanical systems.</p> <p>Forces and Motion: Students will explore how forces affect the movement and stability of objects, including concepts like velocity, acceleration, and Newton's laws of motion.</p> <p>Mechanical Systems: The study of levers, pulleys, gears, and linkages, emphasizing how these components transmit and transform motion and force in machines.</p> <p>Energy Transfer: Understanding how energy is transferred and transformed within mechanical systems, including concepts like work, power, and efficiency.</p> <p>Mechanical Advantage: Calculating and analyzing the mechanical advantage provided by simple machines and systems, and understanding their practical applications.</p> <p>Statics and Dynamics: Applying principles of statics and dynamics to analyze and solve problems related to forces and motion in engineering contexts.</p> | Internal and external assessment. |

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| <b>Spring 1</b> | Unit F130:<br>Principles of engineering<br><b>Topic area 2</b><br><b>Mechanical principles</b> | <ul style="list-style-type: none"> <li>• Bending moment diagrams</li> <li>• Linear dynamic systems</li> <li>• Parameters and applications</li> <li>• Interpretation of graphs</li> <li>• Newton's laws of motion</li> <li>• Displacement (S), initial velocity (U), final velocity (V), acceleration (A), Time (T) (SUVAT) Equations</li> <li>• Friction</li> <li>• Conservation of energy</li> <li>• Momentum</li> </ul> | <p>By the end of this topic area, students should be able to:</p> <p>Construct and interpret bending moment diagrams for various structural scenarios.</p> <p>Analyze and solve problems involving linear dynamic systems.</p> <p>Apply key mechanical parameters to real-world engineering applications.</p> <p>Interpret and analyze engineering graphs to extract meaningful information.</p> <p>Apply Newton's laws and SUVAT equations to solve motion-related problems.</p> <p>Understand and apply the principles of friction, energy conservation, and momentum in engineering contexts.</p> | Internal and external assessment |
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| <b>Spring 2</b> | Unit F130:<br>Principles of engineering<br><b>Topic area 3</b><br><b>Electrical/electronic principles</b> | <p>This unit is assessed by an exam.</p> <p>In this unit you will learn about the Electrical/electronic principles widely used in the engineering industry.</p> <p><b>Topic:</b></p> <ul style="list-style-type: none"> <li>• Electrical principles</li> <li>• Concepts of electricity</li> <li>• Capacitors and capacitance</li> <li>• Direct Current (DC) networks</li> <li>• Inductors and inductance</li> </ul> | <p>By the end of this section, students will be able to:</p> <p>Solve problems involving voltage, current, resistance, capacitance, and inductance.</p> <p>Analyze and design simple DC electrical systems.</p> <p>Understand how energy is stored, transferred, and controlled in electrical components.</p> <p>Interpret circuit diagrams and apply theoretical principles to real-world engineering situations.</p>                    | This unit is assessed by an exam. |
| <b>Summer 1</b> | Unit F130:<br>Principles of engineering<br><b>Topic area 3</b><br><b>Electrical/electronic principles</b> | <ul style="list-style-type: none"> <li>• Alternating Current (AC)</li> <li>• Electrical efficiency</li> <li>• Analogue and digital circuits</li> </ul>                                                                                                                                                                                                                                                              | <p>By the end of these topics, students should be able to:</p> <p>Explain and analyze how AC systems function and calculate key parameters.</p> <p>Calculate the efficiency of electrical systems and suggest ways to improve it.</p> <p>Differentiate between analogue and digital systems and understand their practical applications.</p> <p>Design and interpret simple circuits involving digital logic and analogue components.</p> | This unit is assessed by an exam. |

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| <b>Summer 2</b> | Unit F130:<br>Principles of engineering<br><b>Topic area 1,2 and 3 revision</b> | Students will do revision of all three topic areas:<br><b>Topic area 1 Mathematics</b><br><b>Mechanical principles</b><br><b>Electrical/electronic principles</b> | <p><b>Algebraic Manipulation:</b> Simplifying expressions, solving linear and quadratic equations, and working with inequalities.</p> <p><b>Coordinate Geometry:</b> Understanding straight lines, gradients, and equations of lines.</p> <p><b>Trigonometry:</b> Applying sine, cosine, and tangent functions, including the use of trigonometric identities.</p> <p><b>Vectors:</b> Basic operations with vectors, including addition, subtraction, and scalar multiplication.</p> <p><b>Calculus:</b> Introduction to differentiation and integration, focusing on their applications in engineering problems.</p> <p><b>Statistics and Probability:</b> Basic concepts of data analysis, including mean, median, standard deviation, and probability distributions.</p> <p><b>Forces and Motion:</b> Understand Newton's Laws of Motion and their application in engineering contexts.</p> <p><b>Mechanical Systems:</b> Study simple machines like levers, pulleys, and gears, and how they transmit and transform motion and force.</p> | Trail Examination paper for Unit F130. |
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|  |  |  | <p><b>Energy Transfer:</b> Learn about work, power, and efficiency in mechanical systems.</p> <p><b>Mechanical Advantage:</b> Calculate and analyze the mechanical advantage provided by simple machines.</p> <p><b>Statics and Dynamics:</b> Apply principles of statics and dynamics to analyze and solve problems related to forces and motion.</p> <p><b>Concepts of Electricity:</b> Understand the basic concepts of voltage, current, resistance, and power.</p> <p><b>Capacitors and Capacitance:</b> Learn how capacitors store and release energy, and their applications in circuits.</p> <p><b>Direct Current (DC) Networks:</b> Analyze series and parallel circuits, and apply Ohm's Law and Kirchhoff's Laws.</p> <p><b>Inductors and Inductance:</b> Study how inductors store energy in magnetic fields and their behavior in circuits.</p> <p><b>Alternating Current (AC):</b> Understand the characteristics of AC, including frequency, amplitude, and phase.</p> <p><b>Electrical Efficiency:</b> Calculate the</p> |  |
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|  |  |  | <p>efficiency of electrical systems and understand energy losses.</p> <p><b>Analogue and Digital Circuits:</b><br/>Differentiate between analogue and digital signals and their applications in circuits.</p> |  |
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