

Mapping Guide

DRAFT

LEVEL 3 CAMBRIDGE ADVANCED NATIONAL (AAQ) IN

# ENGINEERING

**Certificate H027**

**Extended Certificate H127**

For first teaching in 2025

**Mapping the Cambridge Advanced National in Engineering  
to Cambridge Technical in Engineering  
Level 3: 05838-05842, 05877**

# Introduction

Cambridge Advanced Nationals are our new Level 3 qualifications, available for first teaching in 2025. We've worked closely with teachers and representatives from higher education institutions throughout the development process to ensure that these qualifications are of the highest quality, preparing your students for their next steps.

These qualifications offer current, engaging content that is relevant for young people pursuing degree courses and careers across various fields. Students will learn and develop vital practical skills, which they can directly apply to real-life situations and professional scenarios. At the same time, they will also develop a solid foundation of theoretical knowledge and understanding necessary for their progression to university. We've designed these new qualifications to be accessible for all students.

We've created this mapping guide to help you move from the current Level 3 Cambridge Technicals qualifications to the new Cambridge Advanced Nationals qualifications. The guide clearly shows which content is the same as you are used to, and where new content has been introduced.

# This mapping guide

In the tables that follow, you can see:

- new unit details including Topic Area (TA) numbers and titles
- how the new units map to the existing specification units that you may be familiar with
- which content is completely new to these qualifications
- which content from the existing specifications no longer features in the new qualification
- brief comments about the changes we've made.

CAMBRIDGE  
ADVANCED  
NATIONALS

**In each unit, you'll see we now have teaching content in Topic Areas instead of learning outcomes. Read more in the [specification](#).**

# Mapping detail

Cambridge Advanced National (AAQ) in Engineering

Cambridge Technical in Engineering Level 3: 05822–05825, 05873

F130: Principles of engineering		Unit number	LO number	Comment
Topic Area number	Topic Area title			
1	Mathematics	1	LO1	Similar content in terms of algebraic manipulation and solving of equations including simultaneous. But it does not include LO1.2 (simplification of polynomials of degree three or higher) or 1.6 (quadratic equations).
			LO2	The new specification focuses on the equation of straight line ( $y=mx+c$ ) aspect of this LO. It does not include perpendicular and parallel lines, curves, or transforms.
			LO3	A small amount of content on common logarithms (base 10) is covered. All other content, such as the laws of logs and exponentials is not covered in the new unit.
			LO4	Similar in content but does not include content on arcs and sectors of a circle and on common trigonometric values and identities. As before the equations are given in the formula booklet.
		2	LO1	Only focuses on the SI units aspect of this LO.
		3	LO2	Similar in terms of calculating volumes and densities of regular and irregular shapes but the new specification does not include centre of mass calculations.
		23	LO1	Similar in content regarding LO1.1 and 1.2 regarding calculating volume and surface of solids. And LO2.6 in terms of linear simultaneous equations.

**Cambridge Advanced National (AAQ) in Engineering**

**Cambridge Technical in Engineering Level 3: 05822–05825, 05873**

<b>F130: Principles of engineering</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
2	Mechanical principles	2	LO2  LO4	Similar in content for the basics of kinematics and forces (including scale drawings of forces). However, Unit 3 LO5 which is an extension of this LO is more reflective of what is in the new unit. Similar in content in terms of calculations and graphs involved, except for 4.6 and 4.7 that are not covered. Materials properties specifically are covered in F131.
		3	LO1  LO4  LO5	Similar in content however does not include calculations for the factor of safety. Similar in content including bending moment diagrams. However, the new unit does not include cantilever beams. Similar in content to the topic area. Including projectile motion.

<b>F130: Principles of engineering</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
3	Electrical/electronic principles	2	LO3	Similar in content. This topic contains most of LO3 but also includes equations for capacitance in terms of permittivity. There is also an expansion of inductance to look at forces on a wire and Fleming’s left-hand rule for motors and generators.
		4	LO1	Similar in content with the addition of resistor networks involving two power sources. The new topic does not include the measurement of voltage, current and resistance in a circuit and the maximum power theorem.
			LO2	It includes everything about a sine wave (LO2.1 to 2.5). Phase difference is not included as only single-phase waveforms are covered. Only pure resistive AC circuits are covered and RL, RC and RLC circuits are not included in the new unit.
			LO5	Similar in content, but it does not include summing amplifiers. However, expands on gain in terms of power, voltage and current. Also covers cascading circuits, which is an expansion of what is in the current specification.
			LO6	Similar in content. Focuses heavily on logic gates and Boolean derivation, not simplification. It does not include timing logic, i.e., D or T-type flip-flops.

<b>F131: Materials science and technology</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
1	Material properties	2	LO4	LO4.3 properties of materials are required in this topic. Load extension graphs (4.13 and 4.14) are also covered in this new unit, so being able to understand key features about them in general (elastic limits, UTS, modulus of elasticity etc) is the same. The rest of LO4 from Unit 2 is covered in F130.
		11	LO2 LO5	Similar to LO2.1 in terms of the expanded properties needed to be covered from current Unit 2 (see above). Unlike LO5, which is about carrying out testing on materials, the focus of the new specification covers a description of the testing methods.
2	Types of material	11	LO1 LO2 LO4	There is more emphasis on specific materials and structures in this unit rather than generic periodicity, structure, etc. However, the contents of LO1 provide a good basis. Covers LO2.2 standard form of materials. There is similar content to current specification.
3	Effect of processing techniques on material properties	11	LO3	Similar in content to current specification. However, it does not include Thermal Equilibrium Diagrams (TED) but does go into more detail about the stages of common manufacturing/processing techniques.
4	Material failure mechanisms and prevention	11	LO2	Covers LO2.3 safety factors and modes of failure, but the new specification does not include FMEA matrices and includes methods to prevent common failure mechanisms.
5	Sustainable materials and practices in engineering	22	LO1	Similar in content with an expansion from Reduce, Reuse, Recycle to also include Rethink, Refuse and Repair.

**Cambridge Advanced National (AAQ) in Engineering**

**Cambridge Technical in Engineering Level 3: 05822–05825, 05873**

<b>F132: Engineering in practice</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
1	Product analysis	13	LO5	The use of measuring equipment is covered in this unit, but not quality control checks. The remainder of Topic 1, such as the function of different components, is new in the new specification.
2	Produce Computer Aided Design (CAD) mechanical and electronic engineering drawings	6 9 10	LO1 LO1 LO3	This LO covers the electrical part of the topic. LO1 covers the skills and knowledge to produce 2D drawings. However, these drawings are hand drawn and not produced using CAD software, as required in the new Unit 3. The LO covers 2D CAD, including types of views and standards of drawings of mechanical prototypes.
3	Plan the safe manufacture of a mechanical prototype and an electronic circuit prototype	6 8 13	LO2 LO2 LO1	Note that the prototype electronic circuit must be manufactured using either a 'strip board' or a 'printed circuit board (PCB)'. If the strip board approach is used, then aspects of this LO apply. For example, a layout diagram of the circuit must be created using software or by hand. If the PCB approach is used, then the new specification topic is very similar to this LO. There is also some additional content on sustainability to cover in the new specification. The aspects of risk assessments and identifying electrical hazards of this LO are in the new specification. There is no need for a safe working method statement. Planning the safe manufacture of a mechanical prototype is covered by LO1. However, the new unit is more explicit in places; for example by covering the choice of equipment and tools and the sequence of operations and processes required.

<b>F132: Engineering in practice</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
4	Manufacturing processes	6	LO3	<p>The LO covers the manufacture of a PCB and the content is similar, however it is more explicit on safe working practices during the manufacture (from CNC to soldering).</p> <p>This LO has very similar content to manufacture an electronic circuit.</p> <p>The LO here has many of the hand processes that are required to manufacture the mechanical prototype.</p> <p>Only the content on the use of drilling machines is common to both units.</p>
		8	LO3	
		13	LO2	
		13	LO4	
5	Evaluate a prototype	6	LO4	<p>The content of this LO covers what is required to evaluate the circuit board (either on strip board or a printed circuit board).</p> <p>The content of this LO covers what is required to evaluate the circuit board (either on strip board or a printed circuit board). However, in places it covers more advanced topics, such as the use of oscilloscopes.</p> <p>This LO encompasses very similar content, which is required for the evaluation of the mechanical prototype.</p>
		8	LO4	
		13	LO5	



**Cambridge Advanced National (AAQ) in Engineering**

**Cambridge Technical in Engineering Level 3: 05822–05825, 05873**

<b>F133: Computer Aided Design (CAD)</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
1	Produce 3D models using Computer Aided Design (CAD)	10	LO1	Similar content, however there is greater emphasis on dimensioning the model as the aim is to create a to-scale model in the new specification.
2	Create a 3D assembly of multiple components within a CAD software	10	LO2	
3	Creating technical drawings from 3D models	10	LO3	Similar content. There is a focus on BS:8888 rather than ISO standards. There is guidance about the standard that is expected for these and how many drawings a student needs to produce.
4	Simulations in 3D modelling	10	LO4	Similar content, however in addition to students knowing about simulation they also need to apply either Finite Element Analysis (FEA) or Computational Fluid Dynamic (CFD) simulations on their designs.
		12	LO3	Contains most aspects of this LO, however in the new specification students should amend their design based on the results of their simulation.
			LO4	Contains most aspects of this LO, however in the new specification students need to amend their design based on the results of their simulation.

<b>F134: Programmable electronics</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
1	Microcontrollers and microcontroller systems	5	LO5	<p>Similar in content in terms of covering the basics of what microcontrollers are. Though there is no requirement to cover other programmable devices, such as PLCs in the new specification.</p> <p>Similar in content regarding microcontrollers, however there are specific languages that are required by the new specification and it also includes the internal architecture of programmable devices.</p>
		16	LO1	
2	Using input and output devices and other electronic components in microcontroller systems	5	LO3	<p>Similar in content to LO3.2 and 3.3 however the focus in the new specification is about how these inputs and outputs integrate with microcontrollers rather than other electrical circuits.</p> <p>This has direct links to LO5.3 (function and interrelationship of parts of programmable control systems).</p> <p>Similar in content to LO2.1 and 2.2, but different terminology is used in the new specification rather than 'sensors' and 'actuators'.</p>
			LO5	
		7	LO2	
3	Designing, developing, and assembling microcontroller-based programmable systems	5	LO3	<p>LO3.1 (how to apply a systems approach to electrical design) is directly related to what is covered in the new specification in terms of a systems approach to circuit design. However, the focus is on microcontrollers in the new specification.</p> <p>The new specification has a lot of similar content to LO1.2 (circuit simulation and test using CAD software) - this is so students can model their systems.</p> <p>The new specification is primarily looking at testing and fault finding, and does not cover the PCB/soldering part of LO4.</p>
		6	LO1	
			LO4	
4	Programming microcontrollers	16	LO1	<p>Similar in content and covers all of these techniques for microcontroller devices, but not other types of programmable device.</p> <p>Similar in content for microcontroller devices only.</p>
			LO2	

**Cambridge Advanced National (AAQ) in Engineering**

**Cambridge Technical  
in Engineering Level 3:  
05822–05825, 05873**

<b>F135: Mechanical product design</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
1	Product analysis	9	LO2	This LO focuses on how to achieve design solutions and the new specification focuses on analysing existing products. However, many of the skills needed, such as safe product disassembly, are similar.
			LO3	This LO focuses on how to achieve design solutions and the new specification focuses on analysing existing products. However, many of the skills needed, including product disassembly and DFMA are similar.
2	Product redesign	9	LO1	LO1.2 and 1.4 content is all within the new specification topic, and the focus is also about freehand drawing and sketching. Only some of the content from LO1.1 and 1.3 is covered in the new specification, such as isometric views.
			LO4	The LO contains similar content to the new specification topic. However, the new topic provides more detail regarding the design process.

## Cambridge Advanced National (AAQ) in Engineering

## Cambridge Technical in Engineering Level 3: 05822–05825, 05873

<b>F136: Computer Aided Manufacture (CAM)</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
1	Subtractive and additive Computer Aided Manufacturing (CAM) processes	17	LO1	There is some similar content in LO1 about the different additive and subtractive manufacturing processes available. However, the new specification does not cover LO1.3 automation in manufacturing and LO1.4 computer aided planning, but instead covers the characteristics of individual processes in more breadth and depth.
2	Three-dimensional (3D) Computer Aided Design (CAD) modelling of prototype components	10 17	LO1 LO2	In particular LO1.1 about producing 3D models using CAD is covered in the new specification, but only some of LO1.2 applies. LO2.2 covers much of same content for the subtractive manufacture (CNC), but in less detail than the new specification. There is no equivalent content for additive processes in LO2. Design for Subtractive Manufacturing (DFSM) and Design for Additive Manufacturing (DFAM) are only covered in the new specification.
3	Manufacturing prototype components using subtractive processes	17	LO2 LO3	LO2.1 covers similar content in terms of simulating and editing a CNC program, but the new specification does not cover the manual development of a CNC program from scratch. This LO is covered in full in this topic.
4	Manufacturing prototype components using additive processes	17	LO4	This LO is the basis for this topic, however, there is much more detail in terms of additive manufacturing processes in the new specification.
5	Evaluating prototype components manufactured using subtractive and additive manufacturing processes	13	LO5	This LO covers the skills and detail for the quality control checks needed on the two components. The new specification also covers the suitability of the two processes used to make the components.

F137: Electrical devices and circuits		Unit number	LO number	Comment
Topic Area number	Topic Area title			
1	Power sources	4	LO1	The basic content of the LO is covered in this new topic. The new specification also has a focus on simulating and building the circuits throughout this unit, as stated below.
			LO2	LO2.7 to 2.11 about RL, RC, RLC and phasor diagrams are included in this topic. There are also links to waveforms using $A(t) = A \sin(\omega t \pm \Phi)$ which is in LO2.5. However, the new specification expands on this to include parallel configurations alongside series.
		5	LO1	The basic content of the LO is covered in this topic. However, LO1.4 and LO1.5, which is related to power sources in terms of AC-DC rectification and circuit protection, are not covered in this new topic.
			LO1	Simulation of electrical circuits which is covered in LO1 are required throughout the new unit.
		8	LO3	This has similar content regarding the construction of circuits. However, LO3.5 about the construction techniques for joining components is not an explicit requirement of the new specification. Construction of electronic circuits, which is in this LO, is required throughout the new unit.
			LO4	The new content is similar in testing and fault finding to this LO. However, the focus of the new specification is not so much about using data sheets to do so, but more on the methods and equipment to find the fault and test physical circuits. Fault finding of electronic circuits, which is in this LO, is required throughout the new unit.

<b>F137: Electrical devices and circuits</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
2	Semiconductor devices	4	LO4	Similar content with LO4.2 in terms of rectification of an AC signal using diodes either in a single diode or a full wave bridge rectifier. The new specification does not include anything to do with single or 3 phase systems.
		5	LO4	Similar content with LO4.1 in terms of the function, application and operational analysis of semiconductor devices and associated circuits. Note that the diode aspect is covered in the new topic, while the transistor aspect is covered in Topic Area 3.
3	Analogue circuits	5	LO4	Similar content with LO4.1 in terms of the function, application and operational analysis of semiconductor devices and associated circuits. Note that the new topic focuses on the NPN part of this unit. However, there is more emphasis on equations using a common emitter amplifier.
4	Digital circuits	4	LO6	The basic content of logic gates and Boolean from this LO are also covered in the new topic. However, there is a bigger emphasis on simplification in this topic and it includes Demorgan's Law and more depth on flip-flops.
		5	LO4	Aspects of the content from LO4.2, in terms of the function, application and operational analysis of integrated circuits and associated circuits are covered in detail in the new topic.

<b>F138: Mathematics for engineering</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
1	Matrices and determinants	23	LO4	Similar in content with LO4 however there are some differences. In particular, there is no reference to vectors (e.g. position vectors $i, j$ or $k$ ). The new formula booklet contains determinant and inverse matrices methods for a $2 \times 2$ matrix.
2	Differential calculus	1	LO2	Similar in content in terms of graph drawing and being able to relate the graph to its equations, but does not include coordinate geometry or transforms specifically.
		1	LO5	Similar in content regarding differentiation including minimum/maximum points. However, some differential functions are not included. For example, logarithmic ( $\ln x$ and $\log_a x$ ) and $\tan(x)$ functions. As provided in current specifications, there are differentiation methods given in the formula booklet.
		23	LO3	Similar content to LO3.1 to 3.3 inclusive. However, the quotient rule is not included in the new specification. The new specification includes differential methods in a formula booklet.
3	Integral calculus	23	LO3	Similar in content regarding integration including definite integrals. However, some integration methods, such as substitution and partial fractions, are not included in the new specification. However, as with the current specification, there is a formula booklet containing methods. There is additional content on numerical methods in the new specification, which can be used where integration cannot be used. For example, Simpson's rule.

**Cambridge Advanced National (AAQ) in Engineering**

**Cambridge Technical in Engineering Level 3: 05822–05825, 05873**

<b>F138: Mathematics for engineering</b>		<b>Unit number</b>	<b>LO number</b>	<b>Comment</b>
<b>Topic Area number</b>	<b>Topic Area title</b>			
4	Statistics and probability	1	LO6	Similar to content with a few additional aspects in the new specification about outliers.
5	Indices, exponentials and logarithms	1	LO3	Similar in content, however there is some additional content to be able to plot to a $y=mx+c$ graph from an exponential equation. The new formula booklet includes laws of logarithms.
		23	LO2	Some aspects of similar content with LO2.1 to 2.4 involving indices, exponentials, logarithms and engineering problems.



# Cambridge Technical content not in the Cambridge Advanced National

Cambridge Technical unit number	Cambridge Technical unit title	Cambridge Technical LO number	Cambridge Technical LO title
2	Science for engineering	LO5	Know the basic principles of fluid mechanics
		LO6	Know the basic principles of thermal physics
3	Mechanical engineering	LO3	Understand levers, pulleys and gearing
4	Electrical engineering	LO3	Understand electric motors and generators
		LO4	Understand power supplies and power system protection
5	Electrical and electronic design	LO2	Understand the application of electromagnetism in electrical design
6	Circuit simulation and manufacture	LO5	Understand commercial circuit manufacture
7	Electrical devices	LO1	Understand semiconductor and programmable devices
		LO3	Understand how to use signal conditioning techniques and signal conversion devices
		LO4	Understand the application of smart and modern materials in electrical devices
8	Electrical operations	LO1	Understand the operating and performance characteristics of electrical and electronic components and devices
12	Mechanical simulation and modelling	LO1	Be able to carry out simulations to establish reactions in moving mechanical assemblies
		LO2	Be able to carry out simulations to assess the manufacturability of components or products
13	Mechanical operations	LO3	Be able to use the centre lathe to produce quality components
14	Automation control and robotics	LO1	Understand control system theory in engineering
		LO2	Understand the implementation of control in automated systems
		LO3	Understand sensors and actuators used in automation control systems
		LO4	Know about industrial network systems
		LO5	Know about maintenance in automation control systems
		LO6	Understand the application of robotics in automation control systems

Cambridge Technical unit number	Cambridge Technical unit title	Cambridge Technical LO number	Cambridge Technical LO title
<b>15</b>	Electrical, mechanical, hydraulic and pneumatic control	LO1	Understand the mechanical elements of control systems
		LO2	Understand the electrical elements of control systems
		LO3	Understand simple hydraulic systems
		LO4	Understand simple pneumatic systems
<b>16</b>	Systems and Programming	LO1	Understand programming techniques
		LO2	Be able to program embedded devices in a system
<b>18</b>	Lean and quality	LO1	Understand lean manufacturing
		LO2	Understand approaches used to ensure quality in manufacturing
		LO3	Be able to apply lean manufacturing and approaches used to ensure quality
		LO4	Be able to plan manufacturing production using lean and quality principles and approaches
<b>19</b>	Inspection and testing	LO1	Understand how inspection and testing methods and processes improve quality control
		LO2	Understand how defects can occur in manufacturing materials, processes and components
		LO3	Understand how destructive testing methods are used for quality assurance in manufacturing
		LO4	Understand how non-destructive testing methods are used for quality assurance in a manufacturing environment
		LO5	Understand automatic inspection and testing techniques which are used in manufacturing

Cambridge Technical unit number	Cambridge Technical unit title	Cambridge Technical LO number	Cambridge Technical LO title
<b>20</b>	Business for engineering	LO1	Know how size, ownership and key stakeholders can influence engineering businesses
		LO2	Understand strategies and techniques used to improve engineering businesses
		LO3	Understand external factors which affect engineering businesses
		LO4	Understand influences on innovation and entrepreneurship in engineering
		LO5	Understand key financial terms and documents for engineering businesses
<b>21</b>	Maintenance	LO1	Know about maintenance strategies and operations
		LO2	Understand failure modes
		LO3	Be able to analyse reliability-centred maintenance data
		LO4	Be able to plan maintenance operations
		LO5	Be able to undertake maintenance operations
		LO6	Understand how maintenance issues can inform the design
<b>22</b>	Environmental engineering	LO2	Understand the contribution and potential of renewable energy
		LO3	Know how to evaluate UK performance against global, national and local environmental targets related to engineering
		LO4	Understand environmental arguments for and against global manufacturing
		LO5	Know how innovation is making a difference in the way engineering interacts with the environment
<b>23</b>	Applied mathematics for engineering	LO5	Be able to apply mathematical modelling skills

Cambridge Technical unit number	Cambridge Technical unit title	Cambridge Technical LO number	Cambridge Technical LO title
<b>24</b>	Project management for engineers	LO1	Understand the stages of project management
		LO2	Understand project management roles and the skills needed to be an effective project manager
		LO3	Be able to use project management tools
		LO4	Be able to use the information to support project management decisions
		LO5	Understand how and why projects are monitored
		LO6	Understand how to measure the success of a project
<b>25</b>	Promoting continuous improvement	LO1	Be able to reflect on own performance and performance of systems, processes or artefacts
		LO2	Be able to develop a plan for improvements to a system, process or artefact
		LO3	Be able to implement a plan to make improvements

# Appendix

## Cambridge Technical qualification units and learning outcome (LO) titles

Unit number	Unit title	LO number	LO title
1	Mathematics for engineering	LO1	Understand the application of algebra relevant to engineering problems
		LO2	Be able to use geometry and graphs in the context of engineering problems
		LO3	Understand exponentials and logarithms related to engineering problems
		LO4	Be able to use trigonometry in the context of engineering problems
		LO5	Understand calculus relevant to engineering problems
		LO6	Be able to apply statistics and probability in the context of engineering problems
2	Science for engineering	LO1	Understand applications of SI units and measurement
		LO2	Understand fundamental scientific principles of mechanical engineering
		LO3	Understand fundamental scientific principles of electrical and electronic engineering
		LO4	Understand the properties of materials
		LO5	Know the basic principles of fluid mechanics
		LO6	Know the basic principles of thermal physics
3	Mechanical engineering	LO1	Understand systems of forces and types of loading on mechanical components
		LO2	Understand fundamental geometric properties
		LO3	Understand levers, pulleys and gearing
		LO4	Understand the properties of beams
		LO5	Understand the principles of dynamic systems

Unit number	Unit title	LO number	LO title
4	Electrical engineering	LO1	Understand fundamental electrical principles
		LO2	Understand alternating voltage and current
		LO3	Understand electric motors and generators
		LO4	Understand power supplies and power system protection
		LO5	Understand analogue electronics
		LO6	Understand digital electronics
5	Electrical and electronic design	LO1	Be able to apply AC and DC circuit theory to circuit design
		LO2	Understand the application of electromagnetism in electrical design
		LO3	Be able to apply a systems approach to electrical design
		LO4	Be able to use semiconductors in electrical and electronic design
		LO5	Understand the application of programmable process devices in electronic design
6	Circuit simulation and manufacture	LO1	Be able to use Computer Aided Design (CAD) for circuit design and simulation
		LO2	Be able to use Computer Aided Design (CAD) to design printed circuit boards (PCBs)
		LO3	Be able to manufacture and construct electronic circuits safely
		LO4	Be able to test and perform fault finding on electronic circuits
		LO5	Understand commercial circuit manufacture
7	Electrical devices	LO1	Understand semiconductor and programmable devices
		LO2	Understand electrical sensors and actuators
		LO3	Understand how to use signal conditioning techniques and signal conversion devices
		LO4	Understand the application of smart and modern materials in electrical devices

Unit number	Unit title	LO number	LO title
<b>8</b>	Electrical operations	LO1	Understand the operating and performance characteristics of electrical and electronic components and devices
		LO2	Be able to work safely with electricity
		LO3	Be able to construct electrical and electronic circuits
		LO4	Be able to fault finding electrical and electronic equipment
<b>9</b>	Mechanical design	LO1	Be able to use graphical and engineering drawing techniques to communicate design solutions
		LO2	Be able to select appropriate engineering materials to achieve design solutions
		LO3	Be able to design components that can be successfully manufactured
		LO4	Be able to optimise the design to improve performance
<b>10</b>	Computer Aided Design	LO1	Be able to produce 3D models using Computer Aided Design (CAD)
		LO2	Be able to create 3D assemblies of components within a CAD system
		LO3	Be able to produce 2D CAD engineering drawings
		LO4	Understand the use of simulation tools within CAD systems
<b>11</b>	Material science	LO1	Understand material structure and classification
		LO2	Understand properties, standard forms and failure modes of materials
		LO3	Understand material processing techniques
		LO4	Know the applications and benefits of modern and smart materials
		LO5	Be able to test the suitability of materials for different applications
<b>12</b>	Mechanical simulation and modelling	LO1	Be able to carry out simulations to establish reactions in moving mechanical assemblies
		LO2	Be able to carry out simulations to assess the manufacturability of components or products
		LO3	Be able to carry out Finite Element Analysis (FEA) simulations to assess the operational performance of components
		LO4	Be able to carry out Computational Fluid Dynamic (CFD) simulations to assess the operational performance of components

Unit number	Unit title	LO number	LO title
<b>13</b>	Mechanical operations	LO1	Be able to plan for production in mechanical engineering
		LO2	Be able to use bench processes, tools and equipment to produce quality components
		LO3	Be able to use the centre lathe to produce quality components
		LO4	Be able to use drilling and milling machines to produce quality components
		LO5	Be able to quality assure components
<b>14</b>	Automation control and robotics	LO1	Understand control system theory in engineering
		LO2	Understand the implementation of control in automated systems
		LO3	Understand sensors and actuators used in automation control systems
		LO4	Know about industrial network systems
		LO5	Know about maintenance in automation control systems
		LO6	Understand the application of robotics in automation control systems
<b>15</b>	Electrical, mechanical, hydraulic and pneumatic control	LO1	Understand the mechanical elements of control systems
		LO2	Understand the electrical elements of control systems
		LO3	Understand simple hydraulic systems
		LO4	Understand simple pneumatic systems
<b>16</b>	Systems and Programming	LO1	Understand programming techniques
		LO2	Be able to program embedded devices in a system
		LO3	Be able to program Programmable Logic Controllers (PLCs)
		LO4	Understand commercial testing and validation strategies
<b>17</b>	Computer Aided Manufacturing (CAM)	LO1	Understand how computers are used in manufacturing systems
		LO2	Be able to produce CNC programs for the manufacture of components
		LO3	Be able to set up and operate a CNC machine to produce components
		LO4	Be able to produce components using additive manufacturing techniques



Unit number	Unit title	LO number	LO title
<b>18</b>	Lean and quality	LO1	Understand lean manufacturing
		LO2	Understand approaches used to ensure quality in manufacturing
		LO3	Be able to apply lean manufacturing and approaches used to ensure quality
		LO4	Be able to plan manufacturing production using lean and quality principles and approaches
<b>19</b>	Inspection and testing	LO1	Understand how inspection and testing methods and processes improve quality control
		LO2	Understand how defects can occur in manufacturing materials, processes and components
		LO3	Understand how destructive testing methods are used for quality assurance in manufacturing
		LO4	Understand how non-destructive testing methods are used for quality assurance in a manufacturing environment
		LO5	Understand automatic inspection and testing techniques which are used in manufacturing
<b>20</b>	Business for engineering	LO1	Know how size, ownership and key stakeholders can influence engineering businesses
		LO2	Understand strategies and techniques used to improve engineering businesses
		LO3	Understand external factors which affect engineering businesses
		LO4	Understand influences on innovation and entrepreneurship in engineering
		LO5	Understand key financial terms and documents for engineering businesses
<b>21</b>	Maintenance	LO1	Know about maintenance strategies and operations
		LO2	Understand failure modes
		LO3	Be able to analyse reliability-centred maintenance data
		LO4	Be able to plan maintenance operations
		LO5	Be able to undertake maintenance operations
		LO6	Understand how maintenance issues can inform the design

Unit number	Unit title	LO number	LO title
22	Environmental engineering	LO1	Understand sustainability in engineering
		LO2	Understand the contribution and potential of renewable energy
		LO3	Know how to evaluate UK performance against global, national and local environmental targets related to engineering
		LO4	Understand environmental arguments for and against global manufacturing
		LO5	Know how innovation is making a difference in the way engineering interacts with the environment
23	Applied mathematics for engineering	LO1	Be able to apply trigonometry and geometry to a range of engineering situations
		LO2	Be able to apply knowledge of algebra, equations, functions and graphs to engineering problems
		LO3	Be able to use calculus to analyse a range of problems
		LO4	Understand applications of matrix and vector methods
		LO5	Be able to apply mathematical modelling skills
24	Project management for engineers	LO1	Understand the stages of project management
		LO2	Understand project management roles and the skills needed to be an effective project manager
		LO3	Be able to use project management tools
		LO4	Be able to use the information to support project management decisions
		LO5	Understand how and why projects are monitored
		LO6	Understand how to measure the success of a project
25	Promoting continuous improvement	LO1	Be able to reflect on own performance and performance of systems, processes or artefacts
		LO2	Be able to develop a plan for improvements to a system, process or artefact
		LO3	Be able to implement a plan to make improvements

## Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on  
**01223 553998**

Alternatively, you can email us on  
**support@ocr.org.uk**

For more information visit

 **[ocr.org.uk/qualifications/resource-finder](https://ocr.org.uk/qualifications/resource-finder)**

 **[ocr.org.uk](https://ocr.org.uk)**

 **[facebook.com/ocrexams](https://facebook.com/ocrexams)**

 **[twitter.com/ocrexams](https://twitter.com/ocrexams)**

 **[instagram.com/ocrexaminations](https://instagram.com/ocrexaminations)**

 **[linkedin.com/company/ocr](https://linkedin.com/company/ocr)**

 **[youtube.com/ocrexams](https://youtube.com/ocrexams)**



OCR is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored. © OCR 2023 Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA. Registered company number 3484466. OCR is an exempt charity.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers including A Levels, GCSEs, Cambridge Technicals and Cambridge Nationals.

OCR provides resources to help you deliver our qualifications. These resources do not represent any particular teaching method we expect you to use. We update our resources regularly and aim to make sure content is accurate but please check the OCR website so that you have the most up to date version. OCR cannot be held responsible for any errors or omissions in these resources.

Though we make every effort to check our resources, there may be contradictions between published support and the specification, so it is important that you always use information in the latest specification. We indicate any specification changes within the document itself, change the version number and provide a summary of the changes. If you do notice a discrepancy between the specification and a resource, please [contact us](#).

You can copy and distribute this resource freely if you keep the OCR logo and this small print intact and you acknowledge OCR as the originator of the resource.

OCR acknowledges the use of the following content: N/A

Whether you already offer OCR qualifications, are new to OCR or are thinking about switching, you can request more information using our [Expression of Interest form](#).

Please [get in touch](#) if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.

## We really value your feedback

Click to send us an autogenerated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email address will not be used or shared for any marketing purposes.



Please note – web links are correct at date of publication but other websites may change over time. If you have any problems with a link you may want to navigate to that organisation's website for a direct search.