

## Year 10 Topics

**In year 10** we teach the following topics over the course of the year. Each topic draws on prior learning from previous years and builds on understanding from the KS3 programme of study. Each topic develops and deepens the Core knowledge that will underpin all areas of the curriculum at KS4 and KS5.

<b>Learning Outcome 1:</b>				
<b>Topic</b>	<b>Rationale</b>	<b>Knowledge acquisition</b>	<b>Key vocabulary</b>	<b>Skills and enrichment</b>
<b>Unit R113:</b> Electronic principles LO1	This unit will develop learners' knowledge of basic electronic principles. Learners will consider how these can be applied to the design, maintenance and repair of electrical/electronic systems used within engineering products.	Principles, units and measurement	Current (amps), Electro Motive Force (EMF), Induction/back EMF (henry), potential difference (volts), resistance (ohms), capacitance (farads), power and energy (watts) , Frequency (hertz).	<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <b>Subject Specific Skills:</b>
		Values for voltage, current, resistance and power by calculation	Ohm's Law, power law , ( $V=IR$ , $P=IV$ , $P=I^2R$ )	
	Circuit components, symbols and diagrams, i.e. Interpretation of simple circuit schematic diagrams			
	Series and parallel circuits: <ul style="list-style-type: none"> <li>• Uses of series and parallel circuits</li> <li>• Calculation of resistance within series and parallel circuits</li> </ul>			
	The operation of a potential divider, i.e. <ul style="list-style-type: none"> <li>• Calculation of component values for potential divider circuits</li> <li>• Calculation of output voltage from a potential divider circuit</li> </ul>			
	Types of power sources available	Battery, Solar, Mains and combined.		
	Reasons for selection of suitable power sources.	Portable, e.g. battery, sustainable, e.g. solar, continuous, e.g. mains (under normal conditions)		
	Function and application of voltage regulators in power supply circuits.			
On completion of this unit, learners will have knowledge of how basic electronic circuits operate, and understand how to measure and calculate circuits and their component values as well as how to test circuits				

## Learning Outcome 2:

Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
<b>Unit R113:</b> Electronic principles LO2	<p>This unit will develop learners' knowledge of basic electronic principles. Learners will consider how these can be applied to the design, maintenance and repair of electrical/electronic systems used within engineering products.</p> <p>Learners will understand the fundamentals of electronic circuits and be able to design, construct and test a range of electronic circuits. Learners will use techniques to identify potential electrical hazards and apply fault-finding procedures using appropriate test equipment.</p> <p>On completion of this unit, learners will have knowledge of how basic electronic circuits operate, and understand how to measure and calculate circuits and their component values as well as how to test circuits</p>	Appropriate cable types for specific applications giving reasons for their use.	Solid core, multi-core, ribbon, connection devices.	<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <p><b>Subject Specific Skills:</b></p>
		Identification and application of resistors used in electronic circuits	Fixed (preferred values E12 series), Variable resistors (potentiometers), negative temperature coefficient (NTC), thermistor, light dependent resistors (LDR) Resistor values determined by measurement, calculation and colour code, Rating/tolerance.	
		Identification and application of capacitors used in electronic circuits, i.e. types of capacitor	Polarised, non-polarised, Rating/tolerance.	
		Application and function of resistor/capacitor circuit and RC time constant	555 Timer, Astable, Monostable.	
		Identification, application and function of switches.	Push to break (PTB), push to make (PTM), momentary action, latching, contact arrangements.  Single Pole Single Throw (SPST), Single Pole Double Throw (SPDT), Double Pole Single Throw (DPST), Double Pole Double Throw (DPDT), Reed, micro and toggle.	
		Application, function and benefits of circuit protection, i.e.	Fuse, diode.	
		Systems approach, i.e.	Open and closed loop, input, process, output, feedback, system block diagrams	
		Identification, function and application of input devices.	Photodiode, phototransistor, LDR, NTC thermistor, switch, moisture sensor, microphone Pressure switch.	

	<p>This unit will develop learners' knowledge of basic electronic principles. Learners will consider how these can be applied to the design, maintenance and repair of electrical/electronic systems used within engineering products.</p> <p>Learners will understand the fundamentals of electronic circuits and be able to design, construct and test a range of electronic circuits. Learners will use techniques to identify potential electrical hazards and apply fault-finding procedures using appropriate test equipment.</p> <p>On completion of this unit, learners will have knowledge of how basic electronic circuits operate, and understand how to measure and calculate circuits and their component values as well as how to test circuits</p>	<p>Identification, function and application of process devices, i.e.</p> <ul style="list-style-type: none"> <li>• semi-conductors</li> <li>• Integrated circuits and application of logic gates singly and in combination – single digit counter.</li> </ul>	<p><i>Semi-conductors:</i> Diodes, NPN transistors, single transistor as amplifier or switch, Darlington Pair and transistor arrays.</p> <p><i>Integrated circuits:</i> Operational amplifiers, i.e. comparator, monostable, astable, bistable</p> <p>circuit – logic functions/gates-</p> <ul style="list-style-type: none"> <li>• AND • OR • NAND • NOR • NOT • XOR • application of logic gates singly and in combination–single digit counter.</li> </ul>	
--	---	--	---	--

**Learning Outcome 2:**

<b>Topic</b>	<b>Rationale</b>	<b>Knowledge acquisition</b>	<b>Key vocabulary</b>	<b>Skills and enrichment</b>
<b>Unit R113: Electronic principles</b> LO2	<p>This unit will develop learners' knowledge of basic electronic principles. Learners will consider how these can be applied to the design, maintenance and repair of electrical/electronic systems used within engineering products.</p>	<p>Identification, function and application of output devices.</p>	<p>Piezo-electric, buzzers/sounders, Lamps, Light Emitting Diode (LED), LED 7 segment display, Liquid Crystal Display (LCD), display module, Solenoid, Relays.</p>	
		<p>Application and function of DC electric motor control.</p>	<p>Forward and reverse motor.</p>	
	<p>Learners will understand the fundamentals of electronic circuits and be able to design, construct and test a range of electronic circuits. Learners will use techniques to identify potential electrical hazards and apply fault-finding procedures using appropriate test equipment.</p> <p>On completion of this unit, learners will have knowledge of how basic electronic circuits operate, and understand how to measure and calculate circuits and their component values as well as how to test circuits</p>	<p>Identification of smart and modern materials.</p>	<p>Quantum tunnelling composite (QTC), shape memory alloys (SMA).</p>	

**Learning Outcome 3:**

Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
<p><b>Unit R113:</b> Electronic principles LO3</p>	<p>This unit will develop learners' knowledge of basic electronic principles. Learners will consider how these can be applied to the design, maintenance and repair of electrical/electronic systems used within engineering products.</p>	<p>techniques to identify potential electrical hazards and the reasons for their use</p>	<p>Visual inspection of equipment, portable appliance testing (PAT) compliance, use of residual current device (RCD).</p>	<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <p><b><u>Subject Specific Skills:</u></b></p>
		<p>fault-finding procedures</p>	<p>Visual inspection, the half split method of fault location, testing, i.e. truth tables expected values.</p>	
	<p>Learners will understand the fundamentals of electronic circuits and be able to design, construct and test a range of electronic circuits. Learners will use techniques to identify potential electrical hazards and apply fault-finding procedures using appropriate test equipment.</p> <p>On completion of this unit, learners will have knowledge of how basic electronic circuits operate, and understand how to measure and calculate circuits and their component values as well as how to test circuits</p>	<p>appropriate test equipment</p>	<p>Power supply unit, multimeter for voltage, current, resistance and continuity, logic probe for logic levels, signal generator and oscilloscope (i.e. virtual and physical).</p>	

**Learning Outcome 3:**

Topic	Rationale	Knowledge Acquisition	Key Vocabulary	Skills and Enrichment
<p><b>Unit R113:</b> Electronic principles LO3</p>	<p>This unit will develop learners' knowledge of basic electronic principles. Learners will consider how these can be applied to the design, maintenance and repair of electrical/electronic systems used within engineering products.</p>	<p>Discrete, through hole and surface mount components.</p>		<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <p><b>Subject Specific Skills:</b></p> <ul style="list-style-type: none"> <li>• Automatic test</li> <li>• Visual inspection</li> </ul>
	<p>Learners will understand the fundamentals of electronic circuits and be able to design, construct and test a range of electronic circuits. Learners will use techniques to identify potential electrical hazards and apply fault-finding procedures using appropriate test equipment.</p>	<p>Benefits and drawbacks to the manufacturer of using surface mount components and using alternatives.</p>		
	<p>On completion of this unit, learners will have knowledge of how basic electronic circuits operate, and understand how to measure and calculate circuits and their component values as well as how to test circuits</p>	<p>The manufacturing processes used within commercial circuit construction.</p>	<p>Flow solder process, pick and place robot, manual component placement.</p>	
		<p>Quality assurance methods used during commercial printed circuit board (PCB) production</p>		

**Learning Outcome 1: Be able to use CAD for circuit simulation and design**

Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
<p><b>Unit R114:</b> Simulate, construct and test electronic circuits LO1</p>	<p>This unit covers construction techniques and processes used in the manufacture of electronic and electrical circuits. It uses computer based simulation software to prototype and test the operation of circuits and produce designs for printed circuit boards (PCB)</p> <p>Learners will develop knowledge and understanding of the construction techniques and processes used in the manufacture of electronic and electrical circuits.</p> <p>On completion of this unit, learners will understand how to build and evaluate the performance of a simple electronic circuit.</p> <p>Learners studying for the Certificate will be able to apply knowledge and understanding gained in this unit to help develop their skills further during the completion of Units R115 and R116.</p>		<p>Circuit, schematic, diagram, drawing using CAD software, circuit simulation and test using CAD software, PCB layout production to include both track and component views (e.g. export of schematic diagrams, use of component libraries)</p>	<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <p><u>Subject Specific Skills:</u></p>

**Learning Outcome 2: Be able to construct circuits**

Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
<p><b>Unit R114:</b> Simulate, construct and test electronic circuits LO2</p>		<p>safe use of manually-operated hand tools</p>	<p>soldering iron, wire cutters, wire strippers, pliers, screwdrivers, de-soldering tools, manual/PCB drills, appropriate PPE•</p>	<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <p><b><u>Subject Specific Skills:</u></b></p>
		<p>circuit construction following circuit diagram(s) (e.g. transistor circuits using sensors and switches, alarm circuits, audio circuits, optical circuits, counting circuits, logic circuits)_</p>		
		<p>safe construction of PCBs (e.g. photoresist methods, etch resist methods, engraving)_</p>		
		<p>construction techniques for joining external components</p>	<p>Soldering, connecting between boards (e.g. ribbon cable, connecting plugs and sockets, PCB to case fittings, sleeves, insulation, heat shrink, screw terminals)</p>	

**Learning Outcome 3: Be able to test electronic circuits**

Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
<p><b>Unit R114:</b> Simulate, construct and test electronic circuits LO3</p>		<p>techniques for testing electronic circuits</p>	<p>Visual inspection, i.e.–fitting of incorrect component, misplaced components, dry joint, bridged or damaged PCB tracks.</p>	<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <p><u>Subject Specific Skills:</u></p>
		<p>appropriate testing and fault-finding methods (e.g. continuity testing, test-point voltage, current measurement, signal tracing (e.g. half-split, input to output, output to input))</p>		
		<p>use of physical test equipment (e.g. power supplies, multi-meter, logic probe, oscilloscope, signal generator)</p>		

**Learning Outcome 1: Understand how computers are used in engineering design, manufacture and process control**

Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
<p><b>Unit R115: Engineering applications of computers LO1</b></p>	<p>This unit covers the range of computer and microprocessor applications within engineering and considers how systems are used across a range of engineering activities from product design and development to automated manufacturing, maintenance and stock control.</p>	<p>How computers are used within engineering industries to design new products</p>	<p>how CAD systems and graphical packages are used to design and prototype new products</p>	<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <p><b><u>Subject Specific Skills:</u></b></p>
	<p>Learners will develop knowledge and understanding of the range of computer and microprocessor applications within engineering and will consider how computer systems are used across a range of engineering activities.</p> <p>This unit will explore how computers are used within engineering industries to design and manufacture new products with Computer Aided Design (CAD) and Computer Aided Manufacture (CAM) and the use within automated manufacturing such as Programmable Logic Controllers (PLC), Programmable Interface Controller (PIC).</p>	<p>How computers are used within engineering industries to manufacture products, monitor production and manage process control</p>	<p>how CAM systems are used in the manufacturing process how computers are used to automate manufacturing (e.g. PLC, PIC)_how computers are used to monitor production/production operations (e.g. automated test systems) how computers are used for stock control (e.g. automatic stock movement, Radio Frequency Identification Devices (RFID))</p>	
	<p>On completion of this unit, learners will understand the specific processes involved in electronic systems control and have an appreciation of how computers communicate and transfer data in Human Machine Interface (HMI)_ and expert systems</p>	<p>Features of computer controlled automation (e.g. temperature control, weight control, position sensing, size sensing, workflow, warehousing and product movement, safety systems and machine interlocks).</p>		

**Learning Outcome 2: Understand how computers are used for maintenance of engineering systems**

<b>Topic</b>	<b>Rationale</b>	<b>Knowledge acquisition</b>	<b>Key vocabulary</b>	<b>Skills and enrichment</b>
Unit R115: Engineering applications of computers LO2		how computers are used within engineering system maintenance	Human Machine Interface (HMI), i.e.–system operation, diagnostics and maintenance–use of system operation data–modification or correction of system operation, expert systems, i.e.–use within system operation, diagnostics and maintenance–use of system operation data–interpretation of results to modify or correct system operation.	<ul style="list-style-type: none"><li>• <i>Problem solving-</i></li><li>• <i>Evaluation-</i></li><li>• <i>Analysis-</i></li><li>• <i>Creativity-</i></li><li>• <i>Literacy-</i></li></ul> <u>Subject Specific Skills:</u>

**Learning Outcome 3: Know how computers are used to communicate and use data for production and maintenance**

Topic	Rationale	Knowledge acquisition	Key vocabulary	Skills and enrichment
<p><b>Unit R115:</b> Engineering applications of computers LO3</p>		<p>the use of computers to communicate and exchange data during production operations (e.g. assembly/production recording, efficiency information, cycle times)</p>		<ul style="list-style-type: none"> <li>• <i>Problem solving-</i></li> <li>• <i>Evaluation-</i></li> <li>• <i>Analysis-</i></li> <li>• <i>Creativity-</i></li> <li>• <i>Literacy-</i></li> </ul> <p><b><u>Subject Specific Skills:</u></b></p>
		<p>how data from production operations is used in maintenance (e.g. assembly/production recording, efficiency information, cycle times, maintenance planning)</p>		
		<p>how computers are used to communicate and exchange data for maintenance operations (e.g. remote monitoring of engineered systems, transmission of service data, monitoring and recording maintenance operations, parts used, control of stock, prediction of failure, work scheduling)</p>		
		<p>the use of hand-held computer devices in manufacturing and maintenance systems</p>	<p>bar code scanning (e.g. monitor stock usage, automatic update of service records) service information and instructions (e.g. data loggers, data collection and analysis, work scheduling, maintenance checklists)</p>	