Engineering Programmable Systems: Whole Year Overview (Years Ten & Eleven)

Year 10	Title of topic(s)	Content/knowledge to be taught	Key Vocabulary	Activities and assessments	Useful resources
	TA1 Basic electronic circuit principles 1.2.1 Circuit theory 1.1 Electronic circuit parameters 1.1.2 Unit multiples and submultiples	Explain electron flow and conventional current flow in circuits. Recall and state the meaning of electrical circuit parameters. Simplify and convert quantities using unit multiples and submultiples.	**Electron flow** **Circuit parameters – AI and SI derived units** **Multiples and submultiples**	Low stakes quizzes Revision activities Written assessment activities Practice session on curriculum content Pre Public Exam Practise Paper Explain electron flow and conventional current flow in circuits. Recall and state the meaning of electrical circuit parameters. Simplify and convert quantities using unit multiples and submultiples.	elect_flow_vs_conv_I.pdf (oregonstate.edu) Electrical Units of Measure and Descriptions (electronics-tutorials.ws) units-and-symbols.pdf (theiet.org)
	TA1 Basic electronic circuit principles 1.2 Electronic circuit theory, laws and associated calculations 1.2.1 Circuit theory	Types of signals and current used in electronic circuits by: Examples the difference between an analogue and a digital waveform Explaining alternating current (AC) and direct current (DC) with typical applications for an AC sine waveform and DC square waveform, Explaining: Amplitude Frequency Periodic time Providing a worksheet on waveforms and types of current for students to complete.	**Signals – analogue and digital**	Low stakes quizzes Revision activities Written assessment activities Practice session on curriculum content Pre Public Exam Practice exam Teacher model answers Identify and sketch analogue and digital signals and explain their relative advantages and disadvantages. Identify and sketch analogue and digital signals and explain their relative advantages and disadvantages.	Analog vs. Digital (learn.sparkfun.com) Alternating Current (lunchboxsessions.com)

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	TA1 Basic electronic circuit principles 1.2 Electronic circuit theory, laws and associated calculations 1.2.1 Circuit theory	Series and parallel resistors circuits. Explain with examples the difference between a series and a parallel circuit Show how to calculate the total resistance of a series resistor circuit Show how to calculate the total resistance of a parallel resistor circuit Provide a worksheet with series and parallel circuits for students to complete. Note that resistance in circuits that combine both series and parallel arrangements is not required.	**Series and parallel circuits**	Identify series and parallel resistor circuits, calculate total circuit resistance.	Resistance in series and parallel circuits - How do series and parallel circuits work? OCR 21C - GCSE Physics (Single Science) Revision - OCR 21st Century - BBC Bitesize (bbc.co.uk)
	TA1 Basic electronic circuit principles 1.2 Electronic circuit theory, laws and associated calculations 1.2.2 The relationship between voltage, current and resistance	Ohm's Law and its application in electronics. Explaining the historical context of Ohm's Law Explaining how Ohm's Law can be used to relate voltage, current and resistance of a circuit to one another Showing examples of the application of Ohm's Law in simple resistor circuits; showing how to rearrange Ohm's Law to solve simple circuit problems providing an Ohm's Law worksheet with problems to solve.	**Ohm's Law**	Recall Ohm's Law and use to solve simple circuit problems that involve rearranging formula.	Physics for Kids: Ohm's Law (ducksters.com) Ohms Law Explained - The basics circuit theory (YouTube)

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	TA1 Basic electronic circuit principles 1.2 Electronic circuit theory, laws and associated calculations 1.2.3 The relationship between power, current and voltage	Watt's Law (the Power Law). Explaining the historical context of Watt's Law Explaining how Watt's Law is used to calculate the power from current and resistance in a circuit Showing how Watt's Law can be used to determine the power dissipated in a simple resistor circuit Providing a worksheet with problems to solve using Watt's Law. Note that students are only required to use and rearrange P = I V and not any other form of this equation.	**Watt's Law** **Power** **Current** **Voltage**	Recall Watt's Law (the Power Law) and use to solve simple circuit problems that involve rearranging formula.	What is Watt's law? (engineeringclicks.com) Electric Power (learn.sparkfun.com)
	TA2 Electronic and programmable systems, components and devices 2.2 The purpose, function and typical applications of electronic circuit components and devices including the recognition and interpretation of circuit symbols 2.2.1 Input components and devices	Introduce the systems approach including input, output, and process devices. Introduce the systems approach, explaining how systems are comprised of input, process, and output devicesUse simple examples to illustrate the systems approach, e.g. microwave oven, mobile phone, burglar alarm system Circuit symbols, purpose, function, and typical applications of switches (input devices): Single Pole Single Throw (SPST) switches Push-to-make and push-to-break switches Tilt switches Reed switchesQuantum Tunnelling Composite (QTC) switchesFurther aspects of the systems approach could be introduced in later lessons (e.g. signal arrows, open and closed loop, feedback) once students are familiar with input, output, and process control devices.	**Systems approach** **Systems block diagrams** **Input devices - switches**	Recognise basic parts of a system block diagram – inputs, outputs, process devices. Identify switch types from circuit symbol. Draw circuit symbol. Describe purpose, function, and typical application of each type. Circuit diagrams or schematics are NOT required.	Systems - Electronic systems GCSE Design and Technology Revision - BBC Bitesize (bbc.co.uk) Switches (electronicsclub.info) How a Tilt Switch Works (AKA Mercury Switch) (YouTube) the-right-switch (raeng.org.uk)

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	TA2 Electronic and programmable systems, components and devices 2.2 The purpose, function and typical applications of electronic circuit components and devices including the recognition and interpretation of circuit symbols 2.2.1 Input components and devices	Continue to focus on input devices covering: Light dependent resistors (LDRs) Photodiodes NTC thermistors Pressure sensors Infrared sensors Smart (WiFi enabled) sensors. Showing physical examples to students if available Explaining the purpose, function, and typical Application of these devices Showing relevant circuit symbols used to Represent the devices in circuits (note circuit diagrams or schematics of applications are not required) Producing a quiz where students match devices to a description of their purpose, function, or typical application.	**Input devices** **Light dependent resistors (LDRs)** **Photodiodes** **NTC thermistors** **Pressure sensors** **Infrared sensors** **Smart (WiFi enabled) sensors.**	Identify range of input devices from circuit symbol. Draw circuit symbol. Describe purpose, function, and typical application of each input device. Circuit diagrams or schematics are NOT required.	Sensors and Transducers and Introduction (electronics-tutorials.ws) Light Dependent Resistors (technologystudent.com) The Thermistor - A Level Physics (YouTube) Wireless Sensors Remote Monitoring WiFi Temperature Systems IoT - Monnit (wireless-sensors.co.uk)
	TA2 Electronic and programmable systems, components and devices 2.2 The purpose, function and typical applications of electronic circuit components and devices including the recognition and interpretation of circuit symbols 2.2.3 Output components and devices	Output devices, including: Lamps Light emitting diodes (LEDs) LED displays Liquid crystal displays (LCDs) Buzzers Piezo sounders Motors. Showing physical examples to students if available Explaining the purpose, function, and typical application of these devices Showing relevant circuit symbols used to Represent the devices in circuits (note circuit diagrams or schematics of applications are not required)	**Output devices** **Lamps** **Light emitting diodes (LEDs)** **LED displays** **Liquid crystal displays (LCDs)** **Buzzers** **Piezo sounders** **Motors.**	Producing a quiz where students match devices to a description of their purpose, function or typical application.	Sensors and Transducers and Introduction (electronics-tutorials.ws) LED Basics (YouTube) 7-segment Display and Driving a 7-segment Display (electronics-tutorials.ws) Piezo Buzzers vs. Magnetic Buzzers (islproducts.com) DC Motor, How it works? (YouTube)

Year 10	Title of topic(s)	Content/knowledge to be taught	Key Vocabulary	Activities and assessments	Useful resources
	TA3 Methods of prototyping and testing systems and circuits 3.1 The purpose and characteristics of methods of prototyping circuits and systems	Introduce circuit prototyping (virtual and physical) methods, and virtual testing. Introduce the reasons for prototyping circuits Explain how software is used to virtual prototype circuits through schematic entry of circuit and simulation Show examples of simple circuits comprising input, output and process devices being simulated in software Hold a class discussion on the advantages and disadvantages of using software to prototype circuits.	**Prototyping circuits** **Circuit schematic software** **Circuit simulation**	Recall methods for prototyping circuits including their purpose, characteristics, reasons for use, advantages, and disadvantages.	Circuit Simulation - Electronic Systems Video Lecture (allaboutcircuits.com) Top Ten Online Circuit Simulators (electronics-lab.com)
	TA3 Methods of prototyping and testing systems and circuits 3.2 The main characteristics, purpose and use of physical and virtual measurement and test equipment	Basic introduction to virtual testing of circuits. giving a brief introduction to how circuits are tested virtually in software Showing how virtual test instruments are used to measure basic circuit parameters, e.g. voltage and current Showing how signals/waveforms are created or measured using virtual equipment Explaining the process for using virtual instrumentation. *Students will learn, in more detail, about different measurement and test equipment later.*	**Testing – virtual** **Parameter** **Voltage** **Current** **Signal** **Waveform**	Recall methods for virtual testing, including process to be followed.	Online circuit simulator & schematic editor (circuitlab.com) Online Circuit Simulator with SPICE (partsim.com) Yenka Electronics (yenka.com) DesignSpark (rs-online.com)

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	TA3 Methods of prototyping and testing systems and circuits 3.1 The purpose and characteristics of methods of prototyping circuits and systems	Construction methods for physically prototyping circuits: Modular systems kits Breadboard Stripboard Printed circuit boards (PCBs). Explaining the purpose and reasons for physical prototyping Showing physical examples of different prototyping methods, if available Alternatively, using videos to illustrate and explain the characteristics of different construction methods Holding a class discussion to examine the advantages and disadvantages of each method.	**Prototyping circuits** **Construction methods** **Modular systems kits** **Breadboard** **Stripboard** **Printed circuit boards (PCBs).**	Recall methods for prototyping circuits including their purpose, characteristics, reasons for use, advantages, and disadvantages.	What's The Best Way To Prototype Circuits? (freecodecamp.org) Breadboarding and Prototyping Circuits | Analog Devices (analog.com) Prototyping using breadboard and strip board (YouTube)
	TA2 Electronic and programmable systems, components and devices 2.2.2 Process components and devices	Process devices and their application in circuit: amplifiers counters timers latches pulse generators. Explaining the purpose, function, and typical applications of these devices Showing simple schematic diagrams or circuits using these devices to explain their purpose, function and application Producing a worksheet where students identify devices from descriptions Producing a quiz where students match devices to definitions e.g. amplifier = an electronic device for increasing the amplitude of electrical signals. With suitable resources, show the operation of process devices using simulation software or practical demonstrations. Note: it is not required for students to produce circuits or schematic diagrams of specific circuits.	**Process devices** **Amplifiers** **Counters** **Timers** **Latches** **Pulse generators**	Identify selected process devices from description. Describe purpose, function, and typical application of selected process devices. Circuit diagrams or schematics are NOT required.	Introduction to the Amplifier an Amplifier Tutorial (electronics-tutorials.ws) Counters in Digital Logic (geeksforgeeks.org) 555 Timer Tutorial - The Monostable Multivibrator (electronics-tutorials.ws) Introduction to Latches (electronicshub.org) Simple 555 Pulse Generator circuits | Tested | (eleccircuit.com)

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	TA2 Electronic and programmable systems, components and devices 2.2.2 Process components and devices	Process devices covering: analogue to digital converters. A definition of the A to D converter Explaining its purpose, function, and application in electronic circuits and systems Using simulation software to illustrate how an A to D converter works.	**Process devices** **A to D converter** **Analogue** **Digital**	Identify A to D converter from description. Describe purpose, function, and typical application of A to D converter. Circuit diagrams or schematics are NOT required.	Analogue to Digital Converter (ADC) Basics (electronics-tutorials.ws) What Is ADC Converter [The Ultimate Guide] (dewesoft.com)
	TA2 Electronic and programmable systems, components and devices 2.2.2 Process components and devices	Logic functions and devices, and truth tables: AND OR NOT NAND. A basic introduction to digital electronics Explain the purpose of logic functions Show the symbols for logic functions Show how logic functions work, and how to produce truth tables Produce a worksheet with logic function and truth table problems for students to complete.	**Logic Gate** **Truth table** **AND** **OR** **NOT** **NAND.**	Identify logic functions from symbols, draw logic function symbol. Complete truth tables for single logic gates.	Logic AND Function - Digital Logic Gates (electronics-tutorials.ws) Logic.ly Online Demo [free online logic simulator]

Year 10	Title of topic(s)	Content/knowledge to be taught	Key Vocabulary	Activities and assessments	Useful resources
	TA2 Electronic and programmable systems, components and devices 2.2.2 Process components and devices	Logic functions, their application singly, and in combination (up to two levels). Review the operation of logic functions singly Showing typical applications of logic functions (e.g. burglar alarm circuit (OR), machine safety switches check circuit (AND)) Showing how logic functions can be used in combination (up to two levels only)	**Logic functions** **AND** **OR** **NOT** **NAND** **NOR**	Producing a worksheet with logic functions (singly and combination) and truth table problems for students to complete. Use free online simulation software to demonstrate logic functions singly and in combination. Draw logic circuits and solve logic problems for combination of logic functions up to two levels.	Logic AND Function - Digital Logic Gates (electronics-tutorials.ws) Logic.ly Online Demo [free online logic simulator]
	TA2 Electronic and programmable systems, components and devices 2.2.5 Passive components	Passive components, power supplies and circuit wiring. In these lessons you could focus on resistors, both: Fixed Variable. Explaining the purpose, function, and typical applications of fixed and variable resistors Showing their circuit symbols Showing physical components to students	**Passive components** **Resistors** **Fixed** **Variable.**	Identify selected resistors from circuit symbols. Draw resistor circuit symbols. Describe purpose, function, and typical application of selected resistors. Circuit diagrams or schematics are NOT required. Producing a quiz or worksheet where students Identify or match resistor descriptions to their circuit symbols.	Resistors (learn.sparkfun.com) A Complete Guide to Resistors | RS Components (rs-online.com)

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	TA2 Electronic and programmable systems, components and devices 2.2.5 Passive components	Capacitors: Polarised Non-polarised Explaining the purpose, function, and typical applications of capacitors Explaining the differences between polarised and non-polarised capacitors Showing their circuit symbols, including how polarised and non-polarised capacitors are denoted Showing physical components to students	**Passive components** **Capacitors** **Polarised** **Non-polarised**	Identify selected capacitors from circuit symbols. Draw capacitor circuit symbols. Describe purpose, function, and typical application of selected capacitors. Circuit diagrams or schematics are NOT required. Producing a quiz or worksheet about capacitors for students (e.g. circuit symbols, purpose, function, typical applications). Note that you do not need to cover specific types of capacitors (e.g. electrolytic, ceramic, mica, etc.).	Capacitors (learn.sparkfun.com) How Capacitors Work (electronics.howstuffworks.com)
	TA2 Electronic and programmable systems, components and devices 2.2.5 Passive components	Diodes: Explaining the purpose, function, and typical applications of diodes Showing their circuit symbols Showing physical components to students	**Passive components** **Diodes** **Anode** **Cathode**	Identify diode from circuit symbol. Draw diode circuit symbol. Describe purpose, function, and typical application of diode. Circuit diagrams or schematics are NOT required. Producing a quiz or worksheet about diodes for students to complete (e.g. circuit symbols, purpose, function, typical applications). Note that you only need to look at standard signal/rectifier diodes, and not any other diode type.	Diodes (electronicsclub.info)

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TA2 Electronic and programmable systems, components and devices 2.2.4 Drivers and interface devices:	Revisit output devices and look at the need for drivers and interfaces: NPN transistors Darlington drivers Relays. Explain the purpose of driver and interface circuits and devices Show circuit symbols for individual devices Give examples of their applications Explain, in basic terms, how they function Develop a worksheet on interface drivers and devices for students to complete.	**Drivers and interfaces** **NPN transistors** **Darlington drivers** **Relays.**	Identify driver and interface devices from circuit symbol. Draw circuit symbol of single devices. Describe purpose, function and typical application of driver and interface devices. Circuit diagrams or schematics are NOT required. R048 Students could use drivers and interfaces when simulating and constructing circuits.	Transistors (learn.sparkfun.com) Darlington Transistor and the Sziklai Darlington Pair (electronics-tutorials.ws) How do relays work? (explainthatstuff.com)
TA2 Electronic and programmable systems, components and devices 2.2.6 Power supplies: 2.2.7 Wiring types and their characteristics	Power supplies, and circuit wiring: Power supplies: Batteries Photovoltaic (solar) cells Super capacitor Mains adaptor Wiring: Single strand (solid core) wire Multi-strand (flexible) wire. Providing a brief explanation of different forms of power supplies Providing a brief explanation about different types of wiring Showing physical examples of power supplies and wiring Tasking students to find out about different types of power Supplies, their typical applications and consider their sustainability	**Power supplies** **Wiring types** **Batteries** **Photovoltaic (solar) cells** **Super capacitor** **Mains adaptor** **Wiring:** **Single strand (solid core) wire** **Multi-strand (flexible) wire.**	Explain the suitability of each power supply for different applications including considerations of sustainability. Explain the suitability of different wiring types for different applications. R048/R049 Students will use power supplies and wiring when constructing circuits and programmable systems. Tasking students to find out about different types of wiring, and their suitability for different applications.	How do batteries work? A simple introduction (explainthatstuff.com) Batteries (sustainabilityexchange.ac.uk) How a PV Cell Works - Knowledge Bank (solarschools.net) How do supercapacitors work? (explainthatstuff.com) What is the difference between solid and stranded cables? (universalnetworks.co.uk)

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	TA4 Commercial circuit production and construction methods	Techniques used in commercial PCB production. Use physical resources or videos to show commercial PCBs Explain the purpose and reasons for use of PCBs in products Provide a brief introduction to how PCBs are manufactured and populated with components. Students will cover PCB manufacture and construction in more detail in the following lessons.	**Commercial PCB manufacture**	Summarise the use of PCBs in commercial products. R048 Students will design and manufacture PCBs when constructing circuits	. How Are PCBs Made? A Guide to the PCB Fabrication Process (newburyelectronics.co.uk) How Commercial Printed Circuit Boards Are Made (hackaday.com)
	TA4 Commercial circuit production and construction methods 4.1 Printed circuit boards (PCBs) 4.1.1 The methods and processes for safely producing printed circuit boards (PCBs)	Methods for manufacturing PCBs by: Photo etching CAM milling/routing. Explaining how each of the methods is used to safely manufacture PCBs Using practical demonstrations or videos to show the safe application of each method Summarising the advantages and disadvantages of each method, and reasons for their use.	**Photo etching** **CAM milling**	R048 Students will design and manufacture PCBs when constructing circuits. Explain methods and processes for manufacturing PCBs, including safety considerations, advantages and disadvantages and reasons for use. Students are required to safely use a suitable PCB manufacturing method in Unit R048 so will be able to relate theory with practice.	Circuit Skills: Circuit Board Etching (YouTube) CNC Milling PCB using Eagle, Flatcam and GRBL (YouTube)

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	TA4 Commercial circuit production and construction methods 4.1 Printed circuit boards (PCBs) 4.1.2 The types, characteristics, and typical uses of commercial PCBs	Introduce students to different types of commercial PCBs: Single sided Double sided Flexible. Explain each type, its characteristics, and typical uses Use practical examples or videos to illustrate each type of PCB Task students to investigate and summarise the applications of each different type of PCB.	**Single sided, double sided and flexible PCBs**	R048 Students will design and manufacture PCBs when constructing circuits.	Single-Sided vs. Double-Sided vs. Multilayer PCBs (pcbgogo.com) Flexible PCBs: advantages and disadvantages (proto-electronics.com)
	TA4 Commercial circuit production and construction methods 4.2 The characteristics and processes of commercial circuit assembly methods 4.2.1 The types, characteristics, and typical uses of commercial PCBs	PCB construction and layout methods with the types of components used on them and how these are configured: Surface mount technology (SMT): Pick and place assembly Through-hole construction. Explaining how through-hole and SMT components are used on PCBs, including reasons for their use Explaining the advantages and disadvantages of using both component types Using practical examples or videos to show through-hole and SMT components, and how a pick and place machine operates.	**SMT (Surface mount technology)** **Pick and place** **Through-hole components**	R048 Students will design and manufacture PCBs when constructing circuits.	Surface Mount Electronic Components and their Types (electronicslovers.com) What is SMT: Surface Mount Technology Primer » Electronics Notes (electronics-notes.com) Through-Hole Vs. Surface Mount: Contrasting Benefits and Uses (telancorp.com) PCB Assembly - Pick & Place of SMD Components (eurocircuits.com)

Year 10	Title of topic(s)	Content/knowledge to be taught	Activities and assessments	Assessments	Useful resources
	TA4 Commercial circuit production and construction methods 4.2 The characteristics and processes of commercial circuit assembly methods 4.2.1 The types, characteristics, and typical uses of commercial PCBs	Final lesson on PCB construction, you could look at how components are soldered to the PCB by: Manual soldering Flow soldering. Explain how components are assembled to the PCB by the soldering process Illustrate manual soldering with a demonstration Use videos to show flow soldering Explain the advantages and disadvantages of both methods Hold a class discussion to consider the safety aspects required when performing soldering. Students will undertake practical soldering activities in Unit R048 which will reinforce their understanding of soldering.	**Flow soldering** **Manual soldering**	Describe flow and manual soldering processes including advantages and disadvantages of each method and reasons for use.	R048 Students will design and manufacture PCBs when constructing circuits How To Solder: A Complete Beginners Guide (makerspaces.com) Electronics Assembly (learn.sparkfun.com) Reflow, wave and hand soldering (YouTube) Agrowtek Wave Soldering Process for Electronics Manufacturing (YouTube) .
	TA3 Methods of prototyping and testing systems and circuits	Safe setup and use of test equipment. Recap on previous knowledge of the use of virtual test equipment when performing circuit simulation in software Introduce physical test equipment giving a brief overview of the purpose of key equipment e.g. multimeter for measuring voltage, current and resistance; continuity test for measuring continuity of a conductor; oscilloscope for looking at signals and waveforms, etc use physical equipment or videos to show typical test equipment.	**Testing – virtual and physical**	R048/R049 Students will use virtual and physical testing techniques to test circuits and programmable systems. Recall and summarise reasons for virtual testing. Identify requirements for physical testing including methods to achieve this.	Test Equipment 101 - The Basics of Electronic Testing (circuitbasics.com) Testing & Test Equipment (electronics-notes.com)

Year 10	Title of topic(s)	Content/knowledge to be taught		Activities and assessments	Useful resources
	TA3 Methods of prototyping and testing systems and circuits 3.2 The main characteristics, purpose and use of physical and virtual measurement and test equipment	Detail on the safe setup and operation of the continuity tester and multimeter. Explaining and showing how a continuity tester is used to check the continuity of a conductor Explaining and showing how a multimeter is used to measure voltage, current and resistance Providing physical test equipment for students to practice using Developing a worksheet with questions and problems on using a continuity tester and multimeter for students to complete.	**Multimeter** **Continuity tester**	R048/R049 Students will use physical testing techniques to test circuits and programmable systems. Recall and summarise reasons for virtual testing. Identify requirements for physical testing including methods to achieve this. Describe the safe setup and use of a multimeter to measure DC voltage and current, and resistance. Describe the processes to safely use a continuity tester. Explain the benefits and limitations of each test equipment.	How to Use a Multimeter (learn.sparkfun.com) How to Use a Multimeter (YouTube) What is Continuity and How to Test for it With a Multimeter (YouTube)
	TA3 Methods of prototyping and testing systems and circuits 3.2 The main characteristics, purpose and use of physical and virtual measurement and test equipment	Introduce the oscilloscope and how it is used to display and measure signals. Explaining and showing how an oscilloscope is set up and used to measure voltage signals Providing physical test equipment for students to practice using Using videos if you do not have access to physical equipment Developing a worksheet with questions and problems on using an oscilloscope for students to complete. Students have the opportunity to use an oscilloscope when performing testing in Unit R048. They could also be familiar with the oscilloscope from virtual testing.	**Oscilloscope**	R048/R049 Students will use physical testing techniques to test circuits and programmable systems. Describe the processes to safely use an oscilloscope to test a circuit. Explain the benefits and limitations of the oscilloscope.	How to Use an Oscilloscope (YouTube) How to Use an Oscilloscope (learn.sparkfun.com)
RO47 NEA : Designing, making and testing electronic systems-12 hour independent assessment task					

Year 11	Title of topic(s)	Content/knowledge to be taught	Key Vocabulary	Activities and assessments	Useful resources
	TA3 Methods of prototyping and testing systems and circuits 3.2 The main characteristics, purpose and use of physical and virtual measurement and test equipment	How to safely use a logic probe to check logic signals. Explaining and showing how a logic probe is safely set up and used to measure logic high and logic low signals Providing physical test equipment for students to practice using Developing a worksheet with questions and problems on using a logic probe for students to complete.	**Logic probe**	Describe the processes to safely use a logic probe to test a circuit. Explain the benefits and limitations of using a logic probe. Students could have the opportunity to use a logic probe when performing testing in Unit R048, depending on the type of circuit constructed. They could also be familiar with the logic probe from virtual testing.	Logic Probe - special tool tips and tricks (YouTube) Fix it Friday! - (Logic Series 01) Using a Logic Probe (YouTube)
	TA2 Electronic and programmable systems, components and devices 2.1 Methods of representing electronic circuits and systems and interpretation of them	Return to the systems approach, looking at system block diagrams in more detail, including: Input, process and output blocks Open and closed loop systems Signal arrows Feedback loops. Recap on previous knowledge of block diagrams, using examples to show input, output, and process blocks Explain how signal arrows are used on block diagrams Hold a class discussion to identify systems where feedback is used to control the system (e.g. an oven where you set the desired temperature and the oven controls this temperature) Introduce, using examples, the idea of open loop and closed loop systems.	**Systems approach** **System block diagrams**	Recall from previously the systems approach. Identify input, output, and process parts of block diagrams including signal flow and feedback loops. Identify and explain open and closed loop systems.	Systems - Electronic systems (GCSE Design and Technology Revision - BBC Bitesize) Open-loop System and Open-loop Control Systems (electronics-tutorials.ws) Closed-loop System and Closed-loop Control Systems (electronics-tutorials.ws)

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	TA2 Electronic and programmable systems, components and devices 2.2.1 Input components and devices 2.2.3 Output components and devices	Recap on input and output devices. Explain the purpose of input and output devices Show how they form part of a system, and are used in the systems approach Recap the function and operation of selected input and output devices: input devices: Switches Light Dependent Resistors (LDRs) NTC Thermistor Pressure sensors output devices: Lamps Light emitting diodes (LEDs) LED displays Buzzers Motors	**Output devices** **Input devices**	Recall the purpose function and operation of selected input and output devices in preparation for creating system block diagrams.	Switches (electronicsclub.info) How a Tilt Switch Works (AKA Mercury Switch) (YouTube) the-right-switch (raeng.org.uk) Sensors and Transducers and Introduction (electronics-tutorials.ws) Light Dependent Resistors (technologystudent.com) The Thermistor - A Level Physics (YouTube) Wireless Sensors Remote Monitoring WiFi Temperature Systems IoT - Monnit (wireless-sensors.co.uk) Sensors and Transducers and Introduction (electronics-tutorials.ws) LED Basics (YouTube) 7-segment Display and Driving a 7-segment Display (electronics-tutorials.ws) Piezo Buzzers vs. Magnetic Buzzers (islproducts.com) DC Motor, How it works? (YouTube)
	TA2 Electronic and programmable systems, components and devices 2.1 Methods of representing electronic circuits and systems and interpretation of them	Focus in more detail on the systems approach, giving students the opportunity to review and complete these. Use examples of a selection of simple open and closed loop system block diagrams showing the system layout of familiar products, e.g. oven temperature control, burglar alarm, security light, fridge temperature control, microwave oven Produce a worksheet for students to identify system components, e.g. inputs, outputs, process blocks, feedback loops.	**System block diagrams**	Apply knowledge of system block diagrams, input, output, and process devices to draw or complete system block diagrams. R048/R049 Students will use a systems approach to circuits and programming in both units, including use of input and output devices.	Block Diagram - Learn about Block Diagrams, See Examples (smartdraw.com) Understanding Electronics Block Diagrams with Example (eleccircuit.com)

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	TA2 Electronic and programmable systems, components and devices 2.3 Programmable components and systems	Programmable systems and their applications. Giving a general introduction to programmable systems and their applications in everyday life Using physical examples or videos to illustrate different applications of programmable systems Explaining the reasons for use of programmable systems	**Programmable systems**	Summarise the typical applications of programmable devices including their reasons for use, advantages, and disadvantages. Setting a student activity to investigate the advantages and disadvantages of programmable systems.	What is a microcontroller? ft. Raspberry Pi Pico (YouTube) What is a Microcontroller? (YouTube) What is a microcontroller? (YouTube)
	TA2 Electronic and programmable systems, components and devices 2.3 Programmable components and systems 2.3.1 The main characteristics and typical applications of programmable components	Different types of programmable systems and how they are programmed. In this lesson you could look at microcontrollers. Begin with a general introduction to the microcontroller, highlighting its use in many everyday products and systems Use physical examples or videos to illustrate microcontroller applications Explain, in basic terms, the main characteristics of a microcontroller and how it allows input signals to be processed and outputs to be controlled through programming	**Microcontroller**	Describe the main characteristics and typical applications of microcontrollers Task students to investigate further microcontroller applications. R049 Students will identify and program a microcontroller.	Everything You Need to Know About Microcontrollers | RS Components (rs-online.com) What is a microcontroller? ft. Raspberry Pi Pico (YouTube)

Engineering Programmable Systems: Whole Year Overview (Years Ten & Eleven)

Year 11	Title of topic(s)	Content/knowledge to be taught	Key Vocabulary	Activities and assessments	Useful resources
	TA2 Electronic and programmable systems, components and devices 2.3 Programmable components and systems 2.3.1 The main characteristics and typical applications of programmable components 2.3.2 Types of programming languages and systems and their main features	Continue looking at programmable systems with the Programmable Logic Controller (PLC). Giving a general introduction to the PLC, highlighting its use in industrial systems and applications where they are often in a rugged environment Using physical examples or videos to illustrate PLC applications Explaining, in basic terms, the main characteristics of a microcontroller and how it allows input signals to be processed and outputs to be controlled through programming	**PLC (Programmable Logic Controller)**	Describe the main characteristics and typical applications of PLCs. Tasking students to investigate further PLC applications.	What is Process Automation? (YouTube) Programmable Logic Controller Basics Explained - automation engineering (YouTube) What is Ladder Logic? (YouTube)
	TA2 Electronic and programmable systems, components and devices 2.3.1 The main characteristics and typical applications of programmable components 2.3.2 Types of programming languages and systems and their main features	How programmable devices are programmed. In this lesson you could focus on text-based languages and block-based editors. Illustrating how text-based languages and block-based editors are used to produce a simple program Showing side-by-side examples of an identical program function being implemented using a text-based and a block-based editor Holding a class discussion to identify the advantages and disadvantages of each method.	**Text and block-based editors**	Identify the use of text-based languages and block-based editors and describe the advantages and disadvantages of each type. R049 Students will use selected programming method to program a microcontroller.	Coding, Programming, Block-Based, Text-Based… What Does it All Mean? (teq.com) Block-Based vs. Text-Based Programming (teq.com)

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	TA2 Electronic and programmable systems, components and devices 2.3 Programmable components and systems 2.3.2 Types of programming languages and systems and their main features	How flowcharts are used for programming systems. Illustrate how a flowchart can be used to produce a simple program Explain how different flowchart symbols are used, e.g. start, process, arrow, decision, etc. Hold a class discussion to identify the advantages and disadvantages of using flowcharts for programming. Note that students are not required in this unit to write or produce a program themselves.	**Flowcharts**	Identify the use of flow charts for programming and describe the advantages and disadvantages of using flow charts. Writing or producing programs is NOT required. R049 Students will use selected programming method to program a microcontroller.	Guide to Flowchart Symbols, from Basic to Advanced (gliffy.com) Flowgorithm - Flowchart Programming Language (flowgorithm.org) How to Make a Flowchart for Programming Easy to Understand (technokids.com)
	TA2 Electronic and programmable systems, components and devices 2.3 Programmable components and systems 2.3.2 Types of programming languages and systems and their main features	Consolidate knowledge of their applications, different types of system hardware and how systems are programmed. Produce flashcards on the advantages and disadvantages of different programming techniques for students to match to their relevant programming type, e.g. text-based, block-based, flowchart task students to complete a short presentation on the relative merits of each programming type.	**Programmable systems**	Summarise the relative merits of using different programming techniques for specific applications. R049 Students will use selected programming method to program a microcontroller.	Block-Based vs. Text-Based Programming (teq.com) Guide to Flowchart Symbols, from Basic to Advanced (gliffy.com)
RO49 NEA : Developing Programmable Sytems-12 hour independent assessment task					
Year 11 Revision Program					
RO47 External Assessment: Exam Paper-Electronic Principles					