JOHN PORT SPENCER ACADEMY

Cam Nat Eng Programmable Systems

Curriculum Overview

Key Stage – KS4

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

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

Location of resources:	
Curriculum intent and rationale:	***The engineering & technology curriculum develops students who are not just a generation of hobbyists but are work ready members of society who possess a comprehensive knowledge, understanding and skills set to resiliently tackle everyday design problems.*** ***They are able to create innovative and high-quality solutions that strive to make life better in an increasingly technological world.*** Students are taught in mixed ability groups, with a total of 3 lessons per week. Students follow the OCR Cambridge National Engineering Programmable Systems specification: Cambridge Nationals - Engineering Programmable Systems Level 1/Level 2 - J824 The rationale for teaching OCR Cambridge National in Engineering Programmable Systems is to provide students with essential knowledge and practical skills in electronics and programmable technologies. Learners explore circuit design, microcontrollers, and system development, gaining hands-on experience with CAD software and simulation tools. The course promotes logical thinking, creativity, and problem-solving through real-world challenges. It supports progression to apprenticeships, vocational qualifications, or further study in engineering and digital systems. It engages diverse learners through applied tasks and structured learning. By linking theory to industry practice, this qualification prepares students for future careers in maintenance, installation, and repair sectors with confidence and curiosity.
National Curriculum Links:	**N/A at KS4**

What content needs to be covered? Key Knowledge and skills / misconceptions to address (with vocab in bold and spelling underlined)

By the end of the year students will know:

Yr 10 Half Term 1	Yr 10 Half Term 2	Yr 10 Half Term 3	Yr 10 Half Term 4	Yr 10 Half Term 5	Yr 10 Half Term 6
Students will learn key knowledge and skills about: Methods of representing electronic circuits and systems and interpretation of them: □ Circuit schematics □ Printed circuit board (PCB) layouts Input components and devices: □ Switches: - Single Pole Single Throw (SPST) switches - push-to-make and push-to-break switches □ Sensors: - Light Dependent Resistors (LDRs) Process components and devices: □ Timers Output components and devices: □ Light emitting diodes (LEDs) □ Buzzers □ Motors Drivers and interface devices: □ NPN transistors Passive components: □ Resistors - fixed - variable □ Diodes □ Capacitors - polarised - non-polarised Drawing diagrams or schematics of specific circuits Power supplies: □ Batteries	**Students will learn key knowledge and skills about:** Electronic circuit parameters and their SI or SI derived units of measurement: □ Potential difference - volt (V) □ Current - amp (A) □ Resistance - ohm (Ω) □ Capacitance - farad (F) □ Power - watt (W) □ Frequency - hertz (Hz) Circuit theory: Types of circuits - series circuits o calculation of total resistance The characteristics of types of signals and their waveforms: - analogue - digital Input components and devices: □ Sensors: - NTC thermistors Output components and devices: □ Lamps Wiring types and their characteristics: □ Multi-strand (flexible) wire Create circuits using CAD with a maximum of four system blocks and their associated components Safely test and evaluate electronic circuits: □ Functional testing of assembled PCBs - Measurement of electronic circuit parameters using appropriate equipment - Following safe working procedures when performing functional testing and using test equipment	**Students will learn key knowledge and skills about:** The relationship between voltage, current and resistance: □ Ohm's Law - calculations of voltage, current or resistance using V = I R Drivers and interface devices: □ Darlington drivers Power supplies: □ Mains adaptor The main characteristics, purpose and use of physical and virtual measurement and test equipment: □ Oscilloscope □ Logic probe **Students will recap, retrieve and build on key knowledge and skills:** Half term three will see the continuation of the R048 NEA – Making and testing electronic circuits. This will focus on recalling the skills and knowledge that they have been taught in half term 1 to a controlled assessment task. This recall will focus on **constructing electronic circuits and testing electronic circuits**	**Students will learn key knowledge and skills about:** Electronic circuit parameters and their SI or SI derived units of measurement: □ Frequency - hertz (Hz) Input components and devices: □ Switches: - tilt switches - reed switches Process components and devices: □ Logic functions, devices and their truth tables: - AND - OR - NOT - NAND - Application of logic gates singly and in combination Output components and devices: □ LED displays □ Liquid crystal displays (LCDs) The main characteristics and typical applications of programmable components: □ Microcontrollers Types of programming languages and systems and their main features: □ Flowchart systems	**Students will learn key knowledge and skills about:** Unit multiples and submultiples: □ Mega (M) □ Kilo (k) □ Milli (m) □ Micro (µ) □ Nano (n) □ Pico (p) Methods of representing electronic circuits and systems and interpretation of them: The systems approach and system block diagrams: - open and closed loop systems - input, process and output blocks - signal arrows - feedback loops Process components and devices: □ Analogue to digital converters Power supplies: □ Photovoltaic (solar) cells The purpose and characteristics of methods of prototyping circuits and systems: □ Modular systems kits □ Breadboard □ Stripboard	**Students will learn key knowledge and skills about:** Electronic circuit parameters and their SI or SI derived units of measurement: □ Power - watt (W) Circuit theory: □ Electron flow Types of current - alternating current (AC) - direct current (DC) The relationship between power, current and voltage: □ Watt's Law (power) - calculations of power, current and voltage using P = I V Input components and devices: □ Switches: - Quantum Tunnelling Composite (QTC) switches □ Sensors: - pressure sensors - infrared sensors Wiring types and their characteristics: □ Single strand (solid core) wire The types, characteristics and typical uses of commercial PCBs: □ Double sided □ Flexible

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The purpose and characteristics of methods of prototyping circuits and systems: □ CAD modelling and simulation of circuits and programmable systems □ Printed circuit boards (PCBs) The main characteristics, purpose and use of physical and virtual measurement and test equipment: □ Multimeter □ Continuity tester The safe setup and use of multimeter to measure DC voltage, current and resistance The methods and processes for safely producing printed circuit boards (PCBs): □ Photo etching The types, characteristics and typical uses of commercial PCBs: □ Single sided The types, characteristics and typical uses of commercial PCBs: □ Through-hole construction □ Manual soldering Use Computer Aided Design (CAD) software to produce diagrams and electronic circuits □ Circuit schematics □ Printed circuit board (PCB) layouts Create circuit schematics using standard component symbols Create PCB layouts from schematics. This should include: o use of track and component views o export of schematic diagrams o use of component libraries Use CAD software to simulate/test circuit schematics: □ Overall circuit function □ Function of inputs, processes and outputs Use of virtual instruments within CAD software to measure voltage, current, resistance and signal waveforms Safely produce printed circuit boards (PCBs): □ Production of single sided PCBs □ Drilling holes for components Following safety procedures relevant to the equipment used. This could include the use of: o gloves, safety goggles and tongs when etching o safety goggles when using a PCB drill Safely use tools and equipment to populate and assemble PCBs with components: □ Soldering irons and solder □ Wire cutters □ Wire strippers □ De-soldering tools - Positioning and soldering components and wiring external components to PCBs - Trimming component legs - Cutting wires to size and stripping insulation - Removing excess solder	Identify common faults in circuits: □ Incorrect component placement □ Non-functioning or damaged components □ Track and pad faults □ Incorrectly soldered joints **Students will recap, retrieve and build on key knowledge and skills:** Half term two will see the introduction of the R048 NEA – Making and testing electronic circuits. This will focus on recalling the skills and knowledge that they have been taught in half term 1 to a controlled assessment task – released 1st June. This recall will focus on **drawing and simulating electronic circuits and constructing electronic circuits** **Challenge:** **Students are challenged to achieve the top of mark band 3 in all topic areas of R048.** Independence when constructing circuit schematics Independence when converting a schematic to PCB, with a focus on board component layout, use of labels and size (small as possible) Independence when working through the photoetch process. **Misconceptions:** All components are digital LDRs change light level not resistance Current is measured in 'I'	**Challenge:** **Students are challenged to achieve the top of mark band 3 in all topic areas of R048.** Independence when populating the PCB Use of strain holes Independence when applying tests to the PCB Comparing test findings – real world vs virtual - Justify why they are different **Misconceptions:** Oscilloscopes **generate** waves Strain holes are not needed for all off-board components	Draw block diagrams of programmable systems, including □ Input, process and output blocks □ Signal arrows □ Feedback **Students will recap, retrieve and build on key knowledge and skills:** The first NEA is set for completion and submission this term. This will focus on recalling the skills and knowledge that they have been taught in half term 1 & 2 to a controlled assessment task. This recall will focus on **testing electronic circuits** It will also see the introduction of a project focussed around preparing students for R049 (released 1st June). Recall will focus on input and output components, resistors and capacitors, diodes and the use of CAD for circuit development and testing + the use of virtual test equipment. **Challenge:** **Students are challenged to achieve the top of mark band 3 in all topic areas of R048.** Independence when producing test plans Independence when applying tests to the PCB Comparing test findings – real world vs virtual Challenge students to create diagrams with more than two inputs and outputs Challenge students to add circuit protection devices Independence when converting a schematic to PCB, with a focus on board component layout, use of labels and size (small as possible) **Misconceptions:** A system block diagram is a circuit diagram It doesn't matter which way the arrows go All inputs join together before entering the process device	The methods and processes for safely producing printed circuit boards (PCBs): □ CAM milling/routing The types, characteristics and typical uses of commercial PCBs: □ Surface mount technology (SMT): - pick and place assembly - flow soldering (reflow) □ Through-hole construction - flow soldering - manual component placement (commercial) **Students will recap, retrieve and build on key knowledge and skills:** This term will focus on the project which prepares students for R049 (released 1st June). Recall will be from terms 1-4 of yr 10 and focus **on flowchart systems, drawing and simulating electronic circuits, constructing electronic circuits and testing electronic circuits.** **Challenge:** Independence when working through the photoetch process. Independence when populating the PCB Laying out the circuit similar to a block diagram Independent connection of the jack socket and associated resistors Complexity of flowcharts Use of various flowchart symbols – inclusion of analogue compares, digital diamonds and subroutines Independent development of the flowchart to ensure it functions as intended **Misconceptions:** Pick and place can be used for through hole components Flow and reflow soldering are the same thing You can wave solder SMT CAM milling is faster than photoetching a PCB Solar cells are storage devices	Determine the requirements for programmable systems in order to meet a given brief □ Hardware requirements: - microcontroller type - input and output devices required **Students will recap, retrieve and build on key knowledge and skills:** Half term six will see the introduction of the R049 NEA – Developing programmable systems. This will focus on recalling the skills and knowledge that they have been taught in half term 4 &5 to a controlled assessment task – released 1st June. Half term 4 & 5 recall will focus on **input and output components, system block diagrams and microcontrollers.** **Challenge:** **Students are challenged to achieve the top of mark band 3 in all topic areas of R049.** Independence when choosing input and output devices to solve the given problem Detailed justification of input and output choices. Detailed analysis of microcontroller options / choices Explanations linked to how the system block diagram will function **Misconceptions:** Electrons flow from positive to negative Double sided PCBs can be wave soldered

- Following safe working procedures when using tools and equipment Safely test and evaluate electronic circuits: □ Visual inspection - Visual inspection of tracks, pads and soldered joints - Checking the function of assembled circuits and their inputs, processes and outputs against expected values Identify common faults in circuits: - Checking polarised components are placed the correct way around - Checking component placement matches the PCB layout - Problems with tracks and pads could include: o lifting from the PCB o gaps in or broken tracks - Problems with soldered joints could include: o dry joints o application of too much or too little solder **Challenge:** Independence when constructing circuit schematics Independence when converting a schematic to PCB, with a focus on board component layout, use of labels and size (small as possible) Independence when populating the PCB Use of additional output components Detailed virtual testing of all components Independence when applying tests to the PCB Independently create a test plan Independence when populating the PCB Accurate calibration of variable resistors using a multimeter Comparing test findings – real world vs virtual **Misconceptions:** Settings on multimeters do not need to be adjusted when testing voltage or resistance Continuity is the 'beep test' You can't remove components once they are soldered Etching removes all the copper It doesn't matter which way round you put the artwork in the UV box			Microcontroller and microprocessor are the same thing Tilt switches can measure angles Reed switches are normally open (NO)		
Yr 11 Half Term 1	**Yr 11 Half Term 2**	**Yr 11 Half Term 3**	**Yr 11 Half Term 4**	**Yr 11 Half Term 5**	
Students will learn key knowledge and skills about: The advantages and disadvantages of each method of producing PCBs and the reasons why they are used Determine the requirements for programmable systems in order to meet a given brief □ System requirements: - programming system and/or language to be used - method of downloading programs	**Students will learn key knowledge and skills about:** Input components and devices: □ Sensors: - smart (WiFi enabled) sensors □ Touch screens Output components and devices: □ Piezo sounders The suitability of each power supply for different applications including consideration of sustainability	**Students will learn key knowledge and skills about:** Input components and devices: □ Sensors: - photodiodes The main characteristics and typical applications of programmable components: □ Programmable logic controllers (PLCs)	**Students will learn key knowledge and skills about:** Process components and devices: □ Amplifiers □ Counters □ Latches □ Pulse generators Drivers and interface devices: □ Relays	**Students will learn:** *Exam Preparation (R047)* Revisiting key theory topics: - Electronic components and their functions - Circuit design and analysis - Programming logic and flowcharts - System testing and safety	

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Safely connect input and output devices to the programmable system: □ Selection of appropriate method or methods of connection □ Physically connecting input and output devices Produce microcontroller programs that perform different functions: □ Controlling output components □ Reading and responding to input components: - analogue sensors - digital sensors and switches □ Timers/counters □ Latches □ Logic functions: - AND - OR - NOT □ Feedback loops □ Analogue to digital conversion Simulate and download programs: □ Simulate functionality of programs prior to download **Students will recap, retrieve and build on key knowledge and skills from Year 10:** Half term one of Yr 11 will see the continuation of the R049 NEA – Developing programmable systems. This will focus on recalling the skills and knowledge that they have been taught in half term 4-6 of yr 10 to a controlled assessment task. This recall will focus on **planning the development of programmable systems and developing a programmable system.** This will also see recall of knowledge from half term 1 & 2 of year 10, with a focus around **simulating and constructing electronic circuits**. **Challenge:** **Students are challenged to achieve the top of mark band 3 in all topic areas of R049.** Independence when constructing circuit schematics Independence when converting a schematic to PCB, with a focus on board component layout (I/P/O), use of labels Independence when populating the PCB Complexity of the flowchart, use of subroutines, independent development Detailed justification of power and download methods **Misconceptions:** A microcontroller does not need A to D conversion	The suitability of each wiring type for different applications The main characteristics, purpose and use of physical and virtual measurement and test equipment: □ Signal generator The advantages and disadvantages of using each commercial production method and the reasons why they are used Simulate and download programs: □ Simulate functionality of programs prior to download □ Download programs onto microcontroller hardware Safely test and evaluate programmable systems: □ Visual inspection of system □ Functional testing of system - Completion of a test plan and record - Following safety precautions - Checking that the program has downloaded correctly - Checking that the program controls the system hardware as expected - Visual inspection of input and output device connections **Students will recap, retrieve and build on key knowledge and skills:** Half term two will see the continuation of the R049 NEA – Developing programmable systems. This will focus on recalling the skills and knowledge that they have been taught in half term 5 of year 10 and half term 1 of year 11 to a controlled assessment task. This recall will focus on **constructing electronic circuits, developing flowcharts and testing electronic circuits** **Challenge:** **Students are challenged to achieve the top of mark band 3 in all topic areas of R049.** Independence when populating the PCB Independence when testing and developing the final solution to meet the brief Detailed test plan that is supported by video clips for each test and detailed justification When looking at +/- style questions, generating 3 of each **Misconceptions:** A touch screen is an output device Batteries can't be recharged Pick and place can be used for lots of different shaped PCBs – one after another You can only download a flowchart one to a microcontroller	Types of programming languages and systems and their main features: □ Text-based languages □ Block-based editors The advantages and disadvantages of each type of programming language or system Comparing the relative merits of each programming language for a specific application **Students will recap, retrieve and build on key knowledge and skills:** The second NEA is set for completion and submission this term. This will focus on recalling the skills and knowledge that they have been taught in half term 3 & 5 of year 10 to a controlled assessment task. This recall will focus on **testing electronic circuits and development of flowcharts** **Challenge:** **Students are challenged to achieve the top of mark band 3 in all topic areas of R049.** Detailed evaluation, with supporting justification When looking at +/- style questions, generating 3 of each Be able to list three uses of PLCs **Misconceptions:** PLCs are the same as microcontrollers Block based language is only for beginners Photodiodes detect light by changing resistance	Power supplies: □ Supercapacitor The advantages and disadvantages of using programmable components in the design and manufacture of systems The advantages and disadvantages of each prototyping method and the reasons why they are used The process and safety precautions to follow when using each item of test equipment to test a circuit The benefits and limitations of each item of test equipment **Students will recap, retrieve and build on key knowledge and skills:** This term will focus on the theory in preparation for the examined assessment (R047) This will focus on recalling the skills and knowledge that they have been taught across the whole course. This recall will focus on **testing electronic circuits, capacitors** **Challenge:** When looking at +/- style questions, generating 3 of each Be able to list three uses of supercapacitors Can you think of 3 safety precautions that could be applied to all test equipment? **Misconceptions:** Counters can only count to 7 Pulse generators are connected to the output of a circuit Relays have no mechanical parts Microcontrollers are cheap	Practice papers and mock exams: Use OCR sample assessments and mark schemes Focus on command words and exam technique Targeted revision sessions: Based on mock exam feedback Use flashcards, quizzes, and group work *Topics tailored to individual class / student needs – **adaptive teaching*** *Personal learning checklists used to identify areas of weakness* **Students will recap, retrieve and build on key knowledge and skills:** This term will focus on the theory in preparation for the examined assessment (R047) This will focus on recalling the skills and knowledge that they have been taught across the whole course, applying knowledge to various exam style questions. **Challenge:** Challenge will focus around analysis of the command words and generation of answers that satisfy the marks available to each question – focus on gaining full marks for each answer. Analysis of past papers, to allow trends to be spotted. Generation of own exam style questions **Misconceptions:** Vary depending on the group and mock QLA analysis	

Previous learning that is particularly relevant:

Basic Electronics and Circuits Understanding simple circuits (series and parallel) Identifying components like resistors, LEDs, switches, and batteries Using circuit diagrams and symbols Component placement & soldering process **Introduction to Programming** Block-based or text-based programming (e.g. Scratch, Python, or BBC micro:bit) Writing simple algorithms and using logic (if/else, loops) Debugging and testing code	**Year 9 Design and Technology Modules** Planning and evaluating design ideas Using iterative design processes Documenting work and reflecting on outcomes **Problem Solving and Systems Thinking** Breaking down problems into manageable parts Understanding how systems interact (inputs, processes, outputs) Applying logical reasoning to design solutions **Health and Safety Awareness** Safe use of tools and equipment Understanding risk assessments and workshop rules	

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

The OCR Cambridge National in Engineering Programmable Systems prepares students for future learning by building a strong foundation in electronics, programming, and system design. Here's how: **Core Knowledge & Skills** • Students learn the principles of electronic circuits, programmable components, and microcontroller systems. • They gain hands-on experience in constructing, testing, and simulating circuits using CAD software and real tools. **Progression Pathways** • Supports transition to Level 3 qualifications, such as T Levels, A Levels in Engineering or Computer Science, and vocational courses. • Prepares learners for apprenticeships in electronics, automation, and control systems.	**Learning Mindset** • Encourages logical thinking, creativity, and problem-solving through real-world challenges. • Builds confidence and independence, essential for higher education and technical careers. **Practical Experience** • Learners gain confidence using tools, machinery, and quality control / testing techniques.	

Outcomes:
By the end of the year pupils will be able to solve/create/produce/write:

Solve
- Real-world engineering problems using logic, creativity, and programmable systems
- Faults in electronic circuits through diagnostic testing and troubleshooting
- Design challenges by selecting appropriate input/output devices and microcontroller solutions

Create & Produce
- Electronic circuits using CAD software and simulation tools
- Printed Circuit Boards (PCBs) through safe manufacturing techniques
- Programmable systems that meet specific briefs using microcontrollers
- Functional prototypes that demonstrate system operation and purpose

Write
- Technical documentation including circuit diagrams, design plans, and evaluations
- Project reports that explain design decisions, testing outcomes, and improvements
- Reflections on personal development, problem-solving strategies, and teamwork

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

Formative:	**Summative (& cumulative)**	**Opportunities to revisit past learning:**
- **During Practical Tasks (R048 & R049)** Teachers observe students as they build and test circuits or develop programmable systems. Feedback is given on: Circuit accuracy and safety Programming logic and structure Use of tools and equipment Students are encouraged to refine their work before final submission. - **In Planning and Documentation** Students draft flowcharts, test plans, and system designs.	**R047: Principles of Electronic and Programmable Systems (Exam)** A written exam worth 40% of the final grade. Assesses theoretical knowledge of electronic components, systems, and programming logic. **R048: Making and Testing Electronic Circuits (NEA)** Practical task where students design, build, and test electronic circuits. Worth 30% of the final grade. **R049: Developing Programmable Systems (NEA)**	**Integrated Unit Design** The course is structured so that knowledge from the exam unit (R047: Principles of Electronic and Programmable Systems) is directly applied in the NEA units (R048 and R049). For example, understanding of components, logic gates, and circuit theory from R047 is essential when building and testing circuits in R048 and programming systems in R049 **Practical Application of Theory** Students revisit theoretical concepts through hands-on tasks, such as:

Teachers provide feedback on clarity, completeness, and technical accuracy.
This helps students improve their documentation and align with assessment criteria.

- Encouraging Reflection and Improvement
Pupils are encouraged to reflect on their work and make improvements before final submission.
We can give general guidance (not specific solutions) to help students identify areas for development.

- Tracking Progress Against Assessment Objectives
We use checklists and observation records to monitor how well students are meeting the criteria.
This helps inform teaching and ensures students are on track for success.

- **Through Peer and Self-Assessment**

Students review each other's code, circuit designs, or testing outcomes.
Promotes critical thinking and helps them identify improvements in their own work.

- **In Theory Lessons (R047)**

Quizzes, concept checks, and mini-projects are used to assess understanding of electronic principles and programmable systems.
Teachers use results to adjust teaching and revisit challenging topics.

Others include:

- **Verbal feedback during lessons**
- **Written comments on digital portfolios**
- **Checklists and rubrics aligned with assessment objectives**
- **1:1 progress reviews to set targets and next steps**
- **Marking of mock examinations & use of mock feedback lessons**
- **Use of personal learning checklists (electronic)**

Students design and implement programmable control systems using microcontrollers or similar platforms.
Worth 30% of the final grade.

Cumulative assessment is embedded through:

- Progressive skill development: Students build on knowledge and skills from one unit to the next (e.g., circuit design in R048 supports programming in R049).
- Integrated learning: Concepts from the theory unit (R047) are applied in practical NEA tasks.
- Portfolio and documentation: Students maintain records of their design, testing, and evaluation processes, showing growth over time.
- Preparing students for the final exam (R047) by revisiting and applying theory throughout the course.
- Encouraging reflection and improvement through teacher feedback and self-assessment during NEA development.
- Mock exams and milestone reviews: Used to track understanding and readiness for final assessments.

Designing and testing circuits
Writing and debugging code
Evaluating system performance
This reinforces learning by applying it in real-world contexts.

Milestone Reviews and Iterative Development
We often use checkpoints during NEA projects to review earlier learning and ensure students are applying it correctly.
Students are encouraged to reflect on feedback and improve their work, revisiting earlier stages of design or programming.

Mock Exams and Practice Tasks
We use mock exams and sample assessment materials to help students revisit and consolidate learning from R047.
These also prepare students for the terminal assessment, reinforcing long-term retention

Teacher-Led Reviews and Recaps
Regular lesson starters, quizzes, low-stakes testing and review sessions are used to revisit key concepts and terminology.

Cross-Unit Skills Transfer
Skills such as problem-solving, testing, documentation, and evaluation are developed across all units, allowing students to refine and revisit them in different contexts.

Feedback and Reflection
Regular formative feedback encourages students to reflect on their progress and revisit earlier work to improve it—especially in the NEA.

Subject specific Revision Programme
Produced for December onwards (Yr 11), it gives pupils a week-by-week guide on which topics to cover / re-cap and when. This is supported by page links to the revision guide and links to exam style questions.

Opportunities for homework (including apps):
Completion of set assignments linked to the NEA
Watching of YouTube clips related to circuit commercial manufacturing processes

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

- Practical applications make learning more meaningful and accessible
- Repetition and retrieval practice from formative and summative assessments
- DT Contribution paid for Pupil Premium – support materials used in school
- PP and SEND students take priority seating within our classrooms
- Scaffolding e.g. modelling, showing exemplar work
- Teaching Materials – clear font, coloured backgrounds, videos / step-by-step images projected on the board to show key processes
- Written Feedback for identified assessments
- Dedicated time in lessons to address misconceptions
- Teachers maintain ambitious goals for SEND and disadvantaged pupils
- Variety of teaching styles used to support individual needs
- Access to SEND information e.g. passports
- Teachers use formative assessment to identify barriers and adapt teaching in real time
- Feedback is specific, actionable, and encouraging, helping pupils understand how to improve
- Purchasing of revision guides for Pupil Premium students

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

Enriching experiences:

The OCR Cambridge National in Engineering Programmable Systems prepares students for future learning by developing core knowledge in electronics, programmable components, and system design. Learners gain hands-on experience constructing and testing circuits, using CAD software, and programming microcontrollers. These skills support progression to Level 3 qualifications, apprenticeships, or further study in engineering, robotics, and digital technologies. The course encourages logical thinking, creativity, and resilience through real-world challenges. It builds confidence, independence, and technical fluency, laying a strong foundation for careers in maintenance, installation, and repair sectors. This qualification empowers students to explore engineering with curiosity and readiness for advanced learning.

Our curriculum supports the school value of:

Joy	*Foster enthusiasm and engagement by offering hands-on, practical learning that connects directly to real-world technology. Students build and test electronic circuits, program microcontrollers, and simulate designs using CAD software—making learning exciting and tangible. Tasks are based on authentic scenarios, encouraging creativity, problem-solving, and innovation. The course suits different learning styles through a mix of theory and applied activities, keeping learners motivated. Collaboration and reflection boost participation, while clear links to careers and progression pathways help students see the value of their work. This dynamic approach inspires curiosity and empowers learners with purpose.*
Progress	*We monitor and support progress through a combination of formative and summative assessment strategies. Teachers track student progress through regular practical tasks and written assessments aligned with the assessment objectives of R048 and R049.* *Feedback is provided through peer critiques, teacher marking, and one-to-one discussions, helping students reflect and improve. Progress in the Non-Exam Assessment (NEA) is monitored through milestone check-ins and portfolio reviews. Differentiated support, including scaffolding, modelling, and targeted intervention, ensures all learners can succeed. Digital tools like CAD software and online portfolios also help track development and showcase learning over time.*
Success	*We celebrate success by giving verbal praise, positive phone calls, reward points and showcasing exceptional performance – such as practical work, NEA content or written pieces.*

Literacy, Oracy and disciplinary language:

Literacy

- Students interpret **technical documentation**, circuit diagrams, and programming instructions.
- They produce **written evaluations**, planning documents, and annotated designs using precise engineering vocabulary.
- Structured tasks encourage clarity, accuracy, and purpose in written communication.

Oracy

- Learners explain design choices, present system solutions, and discuss troubleshooting strategies.
- Group work and peer feedback foster **active listening**, collaborative dialogue, and verbal reasoning.
- Real-world scenarios simulate workplace communication, building confidence in technical discussions.

Disciplinary Language

- Students use terms like **microcontroller**, **input/output blocks**, **resistors**, and **logic gates** with fluency.
- They apply subject-specific language to describe processes, justify decisions, and solve problems.
- Exposure to authentic engineering contexts helps learners "talk like technicians," preparing them for future study and employment.

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

Cross-curricular opportunities:

- **Mathematics:** Students apply algebra, logic, and data analysis when designing circuits, calculating resistance, and programming systems.
- **Science (Physics):** Concepts like voltage, current, resistance, and energy transfer are central to understanding electronic systems.
- **Computing & ICT:** Learners use CAD software, simulate circuits, and write microcontroller programs—bridging hardware and software.
- **Design & Technology:** Reinforces design thinking, prototyping, and iterative development through hands-on projects.
- **English:** Supports literacy through technical documentation, evaluations, and presenting design ideas clearly.
- **Business Studies:** Links to product development, cost analysis, and understanding market needs in programmable systems.
- **Environmental Science:** Encourages consideration of sustainability, energy efficiency, and ethical sourcing in system design.

These connections make learning more dynamic and relevant, while preparing students for future study and careers across STEM and beyond.

Opportunities to develop 'character':

Independence & Responsibility

- Students manage their own projects, follow safety protocols, and make design decisions—building ownership and self-discipline.
- Planning and completing tasks fosters time management and accountability.

Resilience & Problem-Solving

- Learners face real engineering challenges, learning to adapt, troubleshoot, and improve through iteration.
- Mistakes become learning moments, encouraging perseverance and confidence.

Collaboration & Respect

- Group tasks and peer feedback nurture teamwork, empathy, and constructive communication.
- Students learn to listen, support others, and value diverse perspectives.

Integrity & Professionalism

- Working with programmable systems teaches precision, ethical decision-making, and pride in craftsmanship.
- Students develop a mindset aligned with industry expectations and personal growth.

Our curriculum supports personal development by:

Independence & Ownership

- Students plan, build, and test their own programmable systems, fostering self-reliance and decision-making.

Act with care, kindness, respect, and integrity	*We build meaningful connections with our students starting with hands-on learning that empowers students to create real products. Teachers celebrate individual progress, offer personalised feedback, and tailor instruction to different learning styles. Linking projects to real-world industries and careers helps students see relevance and value. Regular check-ins and reflection foster confidence and resilience. By creating a supportive, inclusive environment where every contribution matters, we help students feel seen, heard, and motivated—making engineering not just a subject, but a personal journey of growth and discovery.*

- Managing projects and following safety protocols builds responsibility and discipline.

Problem-Solving & Resilience

- Learners face real engineering challenges, learning to troubleshoot, adapt, and improve through iteration.
- Mistakes become growth opportunities, encouraging perseverance and confidence.

Communication & Collaboration

- Group tasks and peer feedback develop teamwork, empathy, and verbal reasoning.
- Students learn to express ideas clearly and respectfully—mirroring workplace dynamics.

Career Readiness & Self-Belief

- Exposure to industry tools and scenarios boosts ambition and self-efficacy.
- Success in practical tasks reinforces pride and a sense of achievement.

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

Technical Skills

- Students learn to design, construct, and test electronic circuits and programmable systems.
- They use CAD software to simulate and produce circuit diagrams, gaining fluency in industry-standard tools.
- The course covers microcontroller programming, preparing learners for roles in automation, robotics, and electronics.

Core Employability Skills

- **Problem-Solving:** Learners tackle real-world engineering challenges, using logic and creativity to design and refine programmable systems.
- **Digital Literacy:** Students gain fluency in CAD software, circuit simulation tools, and microcontroller programming—key skills in modern industry.
- **Communication:** They document processes, explain design choices, and collaborate effectively, building confidence in technical and verbal expression.
- **Teamwork:** Group tasks and peer feedback foster cooperation, adaptability, and respect for diverse perspectives.
- **Resilience & Initiative:** Hands-on projects encourage persistence, independent learning, and self-motivation.
- **Attention to Detail:** Precision in circuit design, testing, and evaluation builds accuracy and accountability.
- **Time Management:** Planning and completing tasks within deadlines develops organisation and prioritisation skills.

Employment Sectors discussed include:

Engineering & Manufacturing

- Maintenance, installation, and repair of electronic systems
- Automation and robotics in industrial settings

- Control systems and instrumentation engineering

Digital & Technology
- Embedded systems development
- Software-hardware integration
- Smart technologies and IoT (Internet of Things)

Electrical & Electronic Engineering
- Circuit design and testing
- Microcontroller programming
- PCB assembly and diagnostics

Aerospace & Automotive
- Electronic control units (ECUs)
- Sensor systems and feedback loops
- Programmable safety and performance systems

Research & Development
- Prototype development
- System simulation and testing
- Innovation in programmable technologies

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

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