# Curriculum planner for the redeveloped Cambridge National in Engineering Programmable Systems (J824)

## Welcome to our curriculum planner

We’ve produced this resource to help you plan your delivery of the redeveloped Cambridge National in Engineering Programmable Systems (J824).

We’ll show you at a high level how you could teach the course over **two or three years**, from September 2022.

A great feature of our redeveloped qualification is the **flexibility** you have in tailoring delivery to suit your needs, so the approaches are just suggestions.

By **integrating the theory and principles of electronics and programmable systems alongside practical activities**, your students will be
able to develop their knowledge and understanding and complementary practical skills and so will be well prepared for **both** the examined and
NEA assessments.

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Take a look at the [Engineering Programmable Systems web page](https://www.ocr.org.uk/qualifications/cambridge-nationals/engineering-programmable-systems-level-1-2-j824/) where you will find the specification, sample assessment material and mapping guide from the current to the redeveloped Cambridge National. You may also find our [guide to understanding assessment](https://www.ocr.org.uk/Images/612302-understanding-the-assessment-examined-and-moderated.pdf) and our [FAQs](https://support.ocr.org.uk/hc/en-gb/articles/360019870179-Cambridge-Nationals-in-Engineering-2022-What-are-the-key-dates-we-need-to-know-) helpful too.

# Assessment summary

| Examined assessment (40% of the course) |
| --- |
| **R047 Principles of electronic and programmable systems**In this unit students will learn about fundamental electrical/electronic concepts, basic circuit theory, electronic and programmable components, and the ways in which electronic systems are represented, tested, and assembled.Topics include:* basic electronic circuit principles
* electronic and programmable systems, components, and devices
* methods of prototyping and testing systems and circuits
* commercial circuit production and construction methods.

Examination: 1 hour 15 minutes | 48 GLH70 Marks |

| Non-examined assessment (60% of the course) |
| --- |
| **R048 Making and testing electronic circuits**In this unit students will learn how to draw and simulate electronic circuits using software, how to manufacture a PCB and construct a circuit, and perform circuit testing.Topics include:* drawing and simulating electronic circuits
* constructing electronic circuits
* testing electronic circuits

OCR-set assignment Approx. 10-12 hours | 36 GLH60 Marks |
| **R049 Developing programmable systems**For this unit students will learn how to develop, programme, and test a programmable system.Topics include:* planning the development of programmable systems
* developing programmable systems
* testing programmable systems

OCR-set assignment Approx. 10-12 hours | 36 GLH60 Marks |

## A reminder about the terminal assessment rule

You must bear in mind the ‘terminal assessment’ requirement; you have to submit all centre-assessed units either **before or in the same series as the final exam is taken.**

Take a look at our guide ‘[Understanding the assessment: examined and moderated’](https://www.ocr.org.uk/Images/612302-understanding-the-assessment-examined-and-moderated.pdf) for more detail.

# Curriculum planning suggestions

Models 1 and 2 below allow for students to develop skills, attempt mock versions of the non-exam assessments before submitting OCR-set assignments and also integrate exam content throughout the course, before drawing the focus in the last term’s teaching.

## Model 1: One teacher over two years

Applies if you are teaching over two years, with internally assessed units delivered with integrated exam content.

|  | Autumn 1 | Autumn 2 | Spring 1 | Spring 2 | Summer 1 | Summer 2 |
| --- | --- | --- | --- | --- | --- | --- |
| **Year 10** | **R047:** Electronic circuit theory, laws, and calculations**R047:** Circuit theory (e.g., electron flow, series and parallel circuits, signals, Ohm’s Law and Watt’s Law)**R047:** Circuit diagrams and components | **R047:** Electronic circuit components, virtual circuit prototyping and testing**R047:** Physical and virtual test equipment (virtual)**R048:** Draw and simulate circuits | **R047:** Physical circuit prototyping methods, electronic circuit components**R048:** Making PCB and constructing circuits**R048**: NEA Assessment (working on) | **R047:** Passive components, power supplies and wiring**R048:** Constructing circuits**R048:** NEA Assessment (working on) | **R047:** Commercial PCB manufacture**R048:** Constructing circuits**R048:** NEA Assessment (working on) | **R047:** Testing systems and circuits**R048:** Testing circuits**R048:** NEA Assessment (submit for moderation)[[1]](#footnote-2) |

|  | Autumn 1 | Autumn 2 | Spring 1 | Spring 2 | Summer 1 | Summer 2 |
| --- | --- | --- | --- | --- | --- | --- |
| **Year 11** | **R047:** Programmable systems, system block diagrams**R049:** Producing system block diagrams**R049:** NEA Assessment (working on) | **R047:** Programmable systems and programming languages**R049:** Selecting and connecting a system**R049:** NEA Assessment (working on) | **R047:** Circuits and circuit theory (revisited)**R048:** NEA Assessment (resubmit for moderation) 1 **R049:** Programming a system**R049:** NEA Assessment (submit for moderation) 1**R047:** Examination (early opportunity)  | **R047:** Electronic components (revisited)**R049:** Programming a system**R049:** System testing**R049:** NEA Assessment (working on) | **R047:** Revision of topic areas/exam revision**R047:** Examination (final opportunity)**R049:** System testing (continues)**R049:** NEA Assessment (resubmit for moderation) 1 |  |

 **See specification for NEA rules:** OCR-set assignments for non-examined assessed (NEA) units are live for one year. Candidates have one resubmission opportunity which may be taken during the series that the assignment is live for. Once an OCR-set assignment brief is no longer live a resubmission is not possible for that brief. Resubmitting work in a different academic assessment series will mean using the new assignment brief for the resubmitted work.

## Model 2: One teacher over three years

Applies if you aim to start teaching in Year 9, with internally assessed units delivered with integrated exam content.

This is just one approach with preparatory work in Year 9.

|  | Autumn 1 | Autumn 2 | Spring 1 | Spring 2 | Summer 1 | Summer 2 |
| --- | --- | --- | --- | --- | --- | --- |
| **Year 9** | Introduction to circuits – basic circuit construction activities | Introduction to input and output devices – with practical activities | Programmable systems – group investigation | Using test equipment – a basic introduction to safe use of the multimeter | Introduction to circuit schematic and simulation software – practical activities | Introduction to circuit schematic and simulation software – practical activities |
| **Year 10** | **R047:** Electronic circuit theory, laws, and calculations**R047:** Circuit theory (e.g. electron flow, series and parallel circuits, signals, Ohm’s Law and Watt’s Law)**R047:** Circuit diagrams and components | **R047:** Electronic circuit components, virtual circuit prototyping and testing**R047:** Physical and virtual test equipment (virtual)**R048:** Draw and simulate circuits | **R047:** Physical circuit prototyping methods, electronic circuit components**R048:** Making PCB and constructing circuits**R048:** NEA Assessment (working on) | **R047:** Passive components, power supplies and wiring**R048:** Constructing circuits**R048:** NEA Assessment (working on) | **R047:** Commercial PCB manufacture**R048:** Constructing circuits**R048:** NEA Assessment (working on) | **R047:** Testing systems and circuits**R048:** Testing circuits**R048:** NEA Assessment (submit for moderation) 1 |

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|  | Autumn 1 | Autumn 2 | Spring 1 | Spring 2 | Summer 1 | Summer 2 |
| --- | --- | --- | --- | --- | --- | --- |
| **Year 11** | **R047:** Programmable systems, system block diagrams**R049:** Producing system block diagrams**R049:** NEA Assessment (working on) | **R047:** Programmable systems and programming languages**R049:** Selecting and connecting a system**R049:** NEA Assessment (working on) | **R047:** Circuits and circuit theory (revisited)**R048:** NEA Assessment (resubmit for moderation) 1**R049:** Programming a system**R049:** NEA Assessment (submit for moderation) 1**R047:** Examination (early opportunity)  | **R047:** Electronic components (revisited)**R049:** Programming a system**R049:** System testing**R049:** NEA Assessment (working on) | **R047:** Revision of topic areas / exam revision**R047:** Examination (final opportunity)**R049:** System testing (continues)**R049:** NEA Assessment (resubmit for moderation) 1 |  |

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# Approaching the content

Below are some suggestions about how you could approach the content in each of the units. We’ve designed them to be developed by you
and your centre to match the needs of your students and your expertise and approach.

| Knowledge and understanding | Practical activities |
| --- | --- |
| **Principles of electronic and programmable systems** Knowledge and understanding of basic electronic theory, components, PCB manufacture and construction and programmable systems development and testing could be integrally taught alongside practical activities and skills developed for the other two NEA units. This should provide an excellent opportunity to contextualise electronic design and construction techniques and programable systems development alongside practice, to internalise learning and to prepare students for the terminal assessment.An introduction to the qualification could include electrical parameters, electrical units and quantities, simple circuits and components, and basic circuit theory. A range of different electronic components and circuit construction techniques could be introduced alongside practical circuit development, simulation, and construction activities and also when looking at input, output, and process devices in programmable systems.The use of block diagrams and knowledge of programmable devices and programming languages will be required when practically developing a programmable system.How to use testing techniques and test equipment, both virtual and safe physical testing, will be required when constructing and testing a circuit and when connecting and testing a programmable system solution.Through integrating theory with practical activities required in NEA units, and using mock and practice assessments, students will be well prepared for the terminal examination in R047. They will be able to relate theory to practice, and to put into context responses to questions they are asked. | **Drawing and simulating circuits**Students will be able to use CAD software to draw, simulate, modify, and virtually test an electronic circuit. Through practice they will become confident in placing components, wiring up circuits on screen and performing simulation and testing using virtual instruments which will prepare them for the NEA assessment in R048.**Producing and constructing PCBs and circuits**Students will be able to take their on-screen circuits and produce PCB layouts ready for manufacture. They will be able to physically manufacture a PCB and practice using circuit construction techniques to be able to assemble components to the PCB to construct working circuits. Safe working in all practical activities will be an essential theme. This will prepare them well for undertaking the NEA assessment in R048.**Testing electronic circuits**Testing includes both virtual testing using virtual instruments in CAD software, and safe physical testing through visual inspection and using physical test instruments. Students will practice both virtual and physical testing, following safe working procedures, in preparation to undertake the NEA assessments in both R048 and R049.**Planning programmable systems development**Planning a programmable system solution requires drawing block diagrams to represent the system, selecting and justifying the hardware and software required, and physically connecting input and output devices using appropriate connection methods. Through research and experimentation, students will become confident in the practical and physical element of programmable system design, and so will be prepared for the NEA assessment activity in R049.**Developing programmable systems**Students will develop skills in being able to use programming software to develop solutions for system problems. They will be able to use the programming software to produce and simulate computer code and will be able to transfer this to physical hardware in preparation for testing. Through practice activities, and trial and error, they will become confident in programming and simulation in preparation for the NEA activity in R049.**Testing programmable systems**This requires developing and implementing a test plan to test correct operation of a programmable system, and to make corrections based on the results obtained. Students will be able to develop realistic test plans, be able to safely apply these, and be able to react to the results obtained. Once familiar with producing plans, carrying out testing, and analysing results they will be well prepared for undertaking the practical testing activity, following safe working practices, in the NEA assessment for R049. |

# Integrating exam content into practical components

We show you below essential knowledge and understanding that students will need for the examined unit, as outlined in the specification.
You should aim to include and reinforce this content in your teaching as much as you can.

| Topic area within examined Unit R047 that can be mapped to NEA: | Students must know and understand: | Students should be able to: |
| --- | --- | --- |
| TA1: Basic electronic circuit principles | Electrical circuit parameters – voltage, current, resistance etc. | **R048** Making and testing electronic circuitsStudents will use virtual and physical test equipment to perform circuit testing, measuring electrical circuit parameters |
| Basic circuit theory, Ohm’s Law and Watt’s Law | **R048** Making and testing electronic circuitsStudents will need to apply basic circuit theory when virtually and physically testing a circuit |
| TA2: Electronic and programmable systems, components, and devices | Block diagrams | **R049** Developing programmable systemsStudents are required to produce a block diagram to represent a programmable system |
| Circuit diagrams | **R048** Making and testing electronic circuitsStudents are required to read and draw circuit diagrams to simulate and construct a circuit |
| Printed Circuit Board (PCB) layouts | **R048** Making and testing electronic circuitsStudents need to used CAD software to produce a PCB layout, and to manufacture a PCB |
| Electronic components – input, process, and output devices | **R048** Making and testing electronic circuitsStudents need to use electronic components to simulate and construct a circuit**R049** Developing programmable systemsStudents need to use electronic components and devices to develop a programmable system solution |
| Passive components – resistors, capacitors, and diodes | **R048** Making and testing electronic circuitsStudents need to use electronic components to simulate and construct a circuit |
| Power supplies | **R048** Making and testing electronic circuitsStudents need to use power supplies to simulate and test a circuit |
| Wiring and cables | **R048** Making and testing electronic circuitsStudents need to use wires and cables to interconnect circuit components when constructing a circuit**R049** Developing programmable systemsStudents will need to use wires and cables when connecting input and output devices to a programmable system |
| Programmable devices and programming languages | **R049** Developing programmable systemsStudents will select, connect, and programme a programmable system to perform a given task |
| TA3: Methods of prototyping and testing systems and circuits | Prototyping methods | **R048** Making and testing electronic circuitsStudents will use suitable prototyping methods when constructing a circuit |
|  | Measurement and test equipment – virtual and physical | **R048** Making and testing electronic circuitsStudents will use both virtual and physical test equipment when testing a circuit construction |
| TA4: Commercial circuit production and construction methods  | Commercial PCB manufacture | **R048** Making and testing electronic circuitsStudents will be able to relate their own PCB manufacture to commercial PCB manufacturing techniques |

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