ENGINEERING PROGRAMMABLE SYSTEMS

INCLUDED ON THE
KS4 PERFORMANCE TABLES

Teacher guide

OCR Level 1/Level 2

Cambridge National in

Engineering Programmable Systems

J824

For first teaching in 2022 | Version 1

Exploring our exams: a guide to our Sample Assessment Material

ocr.org.uk/cambridgenationals

Cambridge Nationals

OCR
Oxford Cambridge and RSA

Introduction

This is Sample Assessment Material (SAM) which has been produced for the qualification OCR Level 1/Level 2 Cambridge National in Engineering Programmable Systems.

The SAM is an example exam paper that we publish alongside a new specification to help illustrate its intended style and structure when a qualification is first launched. We wanted to share the story of our assessment approach with you so when you look through the paper you will find we have pointed out certain features and explained the decisions we have made.

Resources to help support in teaching different areas of content can be found on the Cambridge National in Engineering Programmable Systems webpage under 'Planning and teaching'.

Our exam papers are developed with our accessibility principles in mind. The document 'Understanding the Assessment' tells you a little more about the principles and rationale underpinning our approach for the qualifications. The 'Command Words' are in both 'Understanding the Assessment' and the specification. These tell you what we mean by each command word and how students should approach the question and understand its demand.

You said, we did

During the development of this qualification, **we talked extensively with teachers, subject experts** and our senior assessment teams to influence its structure, content and assessment materials. We then shared our final materials to make sure that they met the identified needs.

You told us that you wanted to **keep the exam as close as possible to the current exam** for the existing Cambridge National in Engineering Programmable Systems, so that's what we have tried to do, by retaining the tone and feel.

You told us that you would like the exam to **start with multiple choice questions** to help students settle, so that's why Section A is made up of multiple choice questions.

You told us that you wanted the exam to be **as short as possible** to keep students focused, so we have used the principle of a mark per minute.

All students will sit the exam at the same time on the same day.

The time allowed is designed to give students approximately one minute per mark.

Students can use a calculator in this exam if needed.

If students require additional answer space, lined pages may be available at the end of the answer booklet in a live question paper. Remember the question number(s) must be clearly shown.

OCR
Oxford Cambridge and RSA

…day … Month Year – Morning/Afternoon

OCR Level 1/Level 2 Cambridge Nationals in Engineering Programmable Systems

Unit R047: Principles of electronic and programmable systems

SAMPLE ASSESSMENT MATERIAL (SAM)

Time allowed: 1 hour 15 minutes

You can use:
- A scientific or graphical calculator

Write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question numbers.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **70**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

DC (…) 000000
Version 2 (July 2021)

OCR is an exempt Charity

Turn over

This exam will always be set and marked by us. Exams will be available in January and June each year. The exam must be taken as terminal assessment. This means that the result from the exam taken in the final assessment series before certification will be the one that counts towards the student's overall grade.

The exam will always have 70 marks. Section A will have 10 marks and Section B will have 60 marks.

Students should use a tick (✓) in the box to show their response to MCQs.

Section A has 10 compulsory multiple choice questions (MCQs).

Section A

Put a tick (✓) in the box next to the **one** correct answer for each question.

1 Which of these is the unit of measurement for frequency?

(a) Amp ☐

(b) Farad ☐

(c) Hertz ☐

(d) Watt ☐

[1]

2 Which of these is best described as the flow of electrons around a circuit?

(a) Capacitance ☐

(b) Current ☐

(c) Resistance ☐

(d) Voltage ☐

[1]

3 How many ohms is 1.5 megaohms (MΩ)?

(a) 1 500 Ω ☐

(b) 15 000 Ω ☐

(c) 150 000 Ω ☐

(d) 1 500 000 Ω ☐

[1]

The number of marks assigned to a question will always be given at the end of the question and will always be right aligned.

4 Which of these is the correct formula for calculating the power in a circuit?

(a) $P = I / V$ ☐

(b) $P = I V$ ☐

(c) $P = I^2 V$ ☐

(d) $P = V / I$ ☐

[1]

5 Which of these best describes the purpose of an output block in a system?

(a) Changes an electronic signal into a physical signal. ☐

(b) Changes a signal from the physical environment into an electronic signal. ☐

(c) Increases the size of an electronic signal. ☐

(d) Processes an electronic signal, such as by latching it on for a period of time. ☐

[1]

MCQs will always have four response options listed in alphabetical or numerical order. The four response options will consist of the correct answer and three distractors.

6 Which of these components is used as an interface device in a circuit?

(a) Buzzer ☐

(b) Diode ☐

(c) Relay ☐

(d) Thermistor ☐

[1]

Each question in this section is worth 1 mark. MCQs will test a range of knowledge from across the unit content.

7 A system with feedback is called a:

(a) Closed process system ☐

(b) Closed loop system ☐

(c) Open loop system ☐

(d) Open process system ☐

[1]

8 Which of these best describes what a logic probe is used for?

(a) To check the signal state of a digital circuit. ☐

(b) To measure the value of an analogue signal. ☐

(c) To produce analogue signal waveforms. ☐

(d) To produce digital signal waveforms. ☐

[1]

9 What component does this circuit symbol represent?

(a) Push-to-break switch ☐

(b) Push-to-make switch ☐

(c) Reed switch ☐

(d) Single pole single throw (SPST) switch ☐

[1]

5

Section B

11 You are developing a child's night light system.

The system must automatically produce a low level of lighting when it is nighttime.
The light must be off during the day.

(a) (i) Identify **one** suitable input component for use in this system.

.....

[1]

(ii) Explain **one** reason why this component is suitable.

.....

.....

.....

..... **[2]**

(b) Identify **two** output components that could be used to produce light in this system.

1.....

2.....

[2]

(c) You are prototyping the night light system using a breadboard.

(i) Explain **two** reasons for using a breadboard to prototype this system.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

Section B contains six questions. Questions will have a mix of question types requiring short or medium responses, calculations, or an extended response. These may be set in context.

These allow us to assess the following Performance Objectives:

- PO1 – Recall knowledge and show understanding
- PO2 – Apply knowledge and understanding
- PO3 – Analyse and evaluate knowledge, understanding and performance.

Sub-content topic areas will be sampled across exam papers, over time.

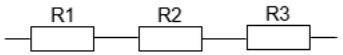
The number of answers needed will always be written as a word in bold.

(ii) State **one** drawback of using a breadboard to prototype this system.

.....

..... **[1]**

12 A resistor arrangement is shown below.



(a) (i) Identify the type of resistor arrangement shown.

..... **[1]**

(ii) The value of each of the resistors is:

R1 = 100 Ω
R2 = 1.2 kΩ
R3 = 4.7 kΩ

Calculate the total resistance of the resistor arrangement.

Give your answer in ohms and show all your working.

Total resistance = ... Ω

[3]

In this example, the unit of measurement is included as part of the question, and also included on the answer line.

We will provide space for students to show their working.

A dedicated answer line for students to write their final answer with the correct unit will be provided.

When a calculation is needed, we will tell students when they should give the unit for their answer and remind them to show all working.

7

(iii) The current flowing through the resistor arrangement is 2 mA.

Using Ohm's Law calculate the potential difference across the arrangement.

Give your answer using the correct unit and show all your working.

.....Potential difference =……..……..Unit =……..

[4]

(b) One application of resistors is to protect an LED from damage.

Identify **two** other applications where fixed or variable resistors can be used in electronic circuits.

1.....

.....

2.....

.....

[2]

8

13 **(a)** Describe **two** differences between analogue and digital signals.

1.....

.....

.....

.....

2.....

.....

.....

.....

[4]

(b) **(i)** Describe the function of a logic OR gate.

.....

.....

.....

..... **[2]**

Where students need to answer in a table it will be centered on the page.

(ii) Complete the truth table below for a logic NAND gate.

Input A	Input B	Output
0	0	
0	1	
1	0	
1	1	

[2]

9

(c) A central heating system is one application of a logic AND function.

Identify **two** other applications of a logic AND function.

1.....

.....

2.....

.....

[2]

14 **(a)** You are testing a single strand wire in a circuit to make sure that it is still capable of conducting electricity.

(i) Identify **two** pieces of test equipment that you could use to do this.

1 .....

2 .....

[2]

(ii) Describe how you would use **one** of the pieces of test equipment named in **(i)** to do this.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

(b) Multi-strand wire can be used to connect batteries to circuit boards.

Explain why multi-strand wire is suitable for this.

.....

.....

.....

.....

.....

.....

[3]

Where contexts are used, information will be concise and specific to the question.

The number of lines given for a question indicate the approximate length of the answer needed.

Short and medium answer responses test knowledge and understanding from across the unit content and allow students the opportunity to give free responses.

15 **(a)** State **three** characteristics of surface mount technology (SMT).

1.....

.....

2.....

.....

3.....

.....

[3]

(b) Describe how a pick and place machine is used to assemble a circuit.

.....

.....

.....

.....

.....

..... **[3]**

(c) Describe the steps to fit and solder components to a PCB using the through-hole construction method.

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

Appendix B in the Specification contains a glossary of Command Words that will be used in our exams. The glossary tells you what we mean by each command word.

16 A company designs and manufactures home security systems using non-programmable circuitry.

The company is considering changing to microcontroller-based systems.

(a) Discuss the advantages and disadvantages to the company of changing from non-programmable circuitry to microcontroller-based systems.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

(b) The company could use a block-based editor to program their new systems.

(i) State **two** features of block-based programming editors.

1.....

.....

2.....

.....

[2]

There will always be one extended response question that is marked by a levels of response mark scheme in Section B of the exam. This will always be a 6 mark question.

When a question asks for a specific number of points, we will always put numbers or response headings against the answer lines to show where students should write each point of their answer.

13

(ii) State **two** drawbacks of using block-based editors to program microcontroller systems.

1 .....

.....

2 .....

.....

[2]

END OF QUESTION PAPER

Indicates to students there are no more questions to answer.

Need to get in touch?

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

Call us on
01223 553998

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

For more information visit
ocr.org.uk/qualifications/resource-finder
ocr.org.uk
/ocrexams
/ocrexams
/company/ocr
/ocrexams

We really value your feedback

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

I like this **I dislike this**

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

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT