

Thursday 9 January 2025 – Afternoon

Level 1/Level 2 Cambridge National in Engineering Programmable Systems

R047/01 Principles of electronic and programmable systems

Time allowed: 1 hour 15 minutes



You can use:

- a calculator



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

Centre number

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Candidate number

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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 number.
- 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

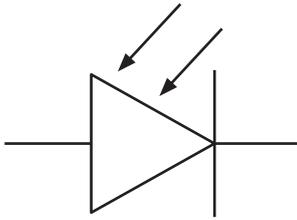
- Read each question carefully before you start your answer.

Section A

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

- 1 What circuit parameter is resistance **best** described as the opposition to?
- (a) Capacitance
 - (b) Current
 - (c) Frequency
 - (d) Power
- [1]
- 2 Which process is used to produce printed circuit boards (PCBs)?
- (a) CAM milling/routing
 - (b) Continuity testing
 - (c) Microcontroller programming
 - (d) Stripboarding
- [1]
- 3 What does a feedback loop show in a system block diagram?
- (a) The input signal becoming an output signal to the same system
 - (b) The output signal becoming an input signal to the same system
 - (c) The signal flow between the input block and process block
 - (d) The signal flow between the process block and output block
- [1]

4 What component does this circuit symbol represent?



- (a) Analogue to digital converter
 (b) Light emitting diode
 (c) Photodiode
 (d) Relay

[1]

5 Which sentence **best** describes a single sided PCB?

- (a) A circuit board that can be bent into different shapes
 (b) A circuit board that has holes that only go through one side of the board
 (c) A circuit board where there are conducting tracks on both sides of the board
 (d) A circuit board where there are conducting tracks on just one side of the board

[1]

6 What unit is potential difference measured in?

- (a) farads
 (b) hertz
 (c) seconds
 (d) volts

[1]

7 Which type of signal is continuous?

- (a) Analogue
 (b) Digital
 (c) Logic
 (d) Square wave

[1]

8 Which of the following is an application of Quantum Tunnelling Composite (QTC) in a circuit?

(a) Charge storage

(b) Light output

(c) Renewable energy source

(d) Touch sensitive switch

[1]

9 What supply does a mains adapter allow a low voltage circuit to run off?

(a) 5V

(b) 12V

(c) 230V

(d) 1000V

[1]

10 Which components can be connected together to create a time delay in a timer circuit?

(a) Capacitor and resistor

(b) Diode and capacitor

(c) Motor and diode

(d) Transistor and resistor

[1]

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Section B

11 You are developing an overheating warning system for a machine in a workshop.

- If the machine temperature gets too hot an audio alarm must sound.
- In addition, a visual output device must display a text-based message showing that there is a problem.

(a)

(i) Identify **one** input sensor that could be used to detect if the temperature is too hot inside the machine. State how it would function to achieve this outcome.

Input sensor

How it functions

.....

[2]

(ii) Identify **one** output device that could be used to provide an audio alarm when the temperature is too hot. State how it would function to achieve this outcome.

Audio output

How it functions

.....

[2]

(iii) Identify **one** visual output device that could be used to display the text-based message showing that there is a problem. State how it would function to achieve this outcome.

Visual output

How it functions

.....

[2]

(b) A programmable logic controller (PLC) will be used as the process device for the overheating warning system.

Evaluate **two** advantages of using a PLC as the process device for this system.

Advantage 1

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Advantage 2

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[4]

12

(a) State **two** advantages and **one** disadvantage of using manual soldering to assemble circuits.

Advantage 1

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Advantage 2

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Disadvantage

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[3]

(b) Describe the process of commercially assembling surface mount technology (SMT) circuits.

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[4]

(c) You are using a continuity tester to check that current can flow between two points on an assembled circuit.

Describe the process of completing this task.

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[3]

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13

(a) Perform the following unit conversions.

(i) 18 000 hertz to kilohertz.

Answer = kHz [1]

(ii) 2200 picofarads to nanofarads.

Answer = nF [1]

(b) A 12V buzzer uses a current of 0.03A.

Calculate the power of the buzzer.

Show all of your working.

Power = W [3]

(c)

(i) What is a **parallel circuit**?

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

(ii) A 10Ω and a 15Ω resistor are connected in parallel.

Calculate the total resistance of this circuit.

Give your answer in ohms and show all of your working .

Total resistance = Ω [4]

14

(a)

(i) State **two** disadvantages of using text-based languages to program systems.

1

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2

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[2]

(ii) Explain **two** advantages of using flowchart software to program systems.

1

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[4]

(b) Explain **two** reasons why CAD software is used to model programmable systems.

1

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2

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[4]

15

(a) You are designing and making a home smoke alarm. A logic OR gate circuit will be used as part of the system.

Describe the function of a logic OR gate.

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..... [2]

(b) The smoke alarm system will be powered using batteries.

Explain **two** reasons why **batteries** would be suitable for powering this system.

1

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2

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..... [4]

(c) Once the OR gate circuit is made it needs to be tested.

Explain **two** benefits of using a **logic probe** to test this circuit.

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2

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[4]

Turn over

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