OCR
Oxford Cambridge and RSA

Thursday 13 June 2024 – Morning

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 | | | | | | 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 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 **12** pages.

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

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Section A

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

1 Which power supply converts sunlight into electrical energy?

(a) Battery ☐

(b) Mains adaptor ☐

(c) Photovoltaic cell ☐

(d) Supercapacitor ☐

[1]

2 Which of these is a unit submultiple?

(a) Giga ☐

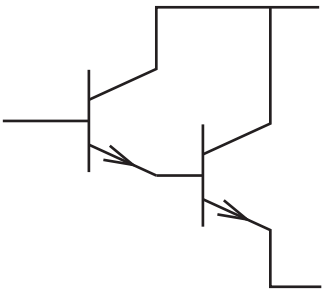
(b) Kilo ☐

(c) Mega ☐

(d) Pico ☐

[1]

3 What is this the circuit symbol for?



(a) Battery ☐

(b) Darlington driver ☐

(c) Relay ☐

(d) Smart (WiFi-enabled) sensor ☐

[1]

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4 What SI unit is power measured in?

(a) hertz ☐

(b) joules ☐

(c) volts ☐

(d) watts ☐

[1]

5 Which is a text-based programming language?

(a) using a series of 1s and 0s ☐

(b) using blocks of pre-written code ☐

(c) using characters and words ☐

(d) using flowchart symbols ☐

[1]

6 Which of the following describes electron flow?

(a) from negative to neutral ☐

(b) from negative to positive ☐

(c) from neutral to positive ☐

(d) from positive to negative ☐

[1]

7 Which item of test equipment would provide waveform signal stimulus for a circuit to test its function?

(a) Continuity tester ☐

(b) Logic probe ☐

(c) Oscilloscope ☐

(d) Signal generator ☐

[1]

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8 Which part of a block diagram shows the direction of signal flow?

(a) Arrows ☐

(b) Blocks ☐

(c) Inputs ☐

(d) Outputs ☐

[1]

9 Which of these is a machine that selects components and positions them on a circuit board?

(a) Automated PCB manufacture ☐

(b) Manual soldering and assembly ☐

(c) Pick and place assembly ☐

(d) PLC programming ☐

[1]

10 What type of wiring would be the most appropriate for connecting a door alarm sensor to a printed circuit board (PCB) with wires?

(a) Multi-strand wire ☐

(b) Ribbon cable ☐

(c) Single strand wire ☐

(d) Solid core wire ☐

[1]

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Section B

11 You are developing a programmable system for a pedestrian road crossing.

- When a person is ready to cross, they must press a button at the side of the road.
- A green light will then visually indicate when it is safe to cross to the other side.
- At this point the system will also make a pulsing sound for those who cannot see the green light.

(a)

(i) Identify **one input** device that could be used as the button for when the user is ready to cross the road.

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

(ii) Identify **one output** device that could be used as the green light to visually indicate when it is safe to cross the road.

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

(iii) Identify **two output** components that could be used to provide the pulsing sound for when it is safe to cross. For **each**, state how it would function to achieve this outcome.

1 .....

How it functions .....

.....

2 .....

How it functions .....

.....

[4]

(b) A motor is being powered by a 12 V power supply. The resistance of the motor has been measured as 60 Ω.

Calculate the current flowing through the motor.

Give your answer using the correct unit.

Show all your working.

Current = ... Unit = ... **[4]**

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(a)

(i) A 47 μF capacitor is being used to set the time period in a timer circuit.
Give **two** other applications of capacitors in circuits.

1 .....

.....

2 .....

.....

[2]

(ii) Convert 47 μF into farads.

Answer = ... F **[1]**

(b) A 180 Ω, 390 Ω and 1.5 kΩ resistor are connected in a series arrangement.

Calculate the total resistance of this arrangement.

Give your answer in ohms.

Show all your working.

Total resistance = ... Ω **[3]**

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(c) A double sided Printed Circuit Board (PCB) will be made for the system circuit.

Evaluate the use of a double sided PCB instead of a single sided PCB for this application.

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

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(a) Describe **two** characteristics of the through-hole PCB construction method.

1 .....

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2 .....

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.....

[4]

(b) Describe the flow soldering process.

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..... **[5]**

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(a) State **three** safety precautions that should be taken when using an oscilloscope.

1 .....

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2 .....

.....

3 .....

.....

[3]

(b) Discuss the benefits and limitations of using a multimeter to test the functionality of an electronic circuit.

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

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15 You are designing a PCB layout.

(a)

(i) Identify **one** process that could be used to manufacture the PCB.

.....

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

(ii) Explain **two** reasons for using this process to manufacture the PCB.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(b)

(i) Other than producing a PCB, state **two** methods that could be used to prototype a logic circuit.

1 .....

.....

2 .....

.....

[2]

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

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

[3]

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(a) Complete the table below by stating the function of each process device and giving an application of each.

Process components and devices	Function	Application
Latch	Keeps the output signal high/low until it is reset	Alarm circuits
Timer		
Pulse generator		
Amplifier		
Analogue to digital converter		

[8]

(b) Explain **one** advantage and **one** disadvantage of using microcontrollers in programmable systems.

Advantage .....

.....

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.....

Disadvantage .....

.....

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[4]

END OF QUESTION PAPER

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