



Oxford Cambridge and RSA

**Tuesday 11 January 2022 – Afternoon**

**Level 1/2 Cambridge National in Systems Control in Engineering**

**R113/01 Electronic principles**

**Time allowed: 1 hour**



**You must have:**

- a scientific or graphical 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)

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Last name

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**INSTRUCTIONS**

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

**INFORMATION**

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [ ].
- Quality of written communication will be assessed in questions marked with an asterisk (\*).
- This document has **8** pages.

**ADVICE**

- Read each question carefully before you start your answer.

Answer **all** the questions.

- 1 (a) (i) Complete the table by using words from the list below.  
Each word may be used once or not at all.

- Automatic
- Continuous
- Portable
- Sustainable
- Unsustainable

Power Source	Type of Power Source
6 V Battery	
1 kW Solar Panel	
230 V AC Mains	

[3]

- (ii) Give **one** drawback of using a sustainable power source.

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

- (iii) Give **one** example of a combined power source for portable equipment.

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

- (b) Calculate the potential difference across a heating element if its resistance is  $70\ \Omega$  and the current flowing through it is  $3.3\text{A}$ .

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

2 Fig. 1 shows part of a circuit diagram with an LED rated at 2 V 20 mA.

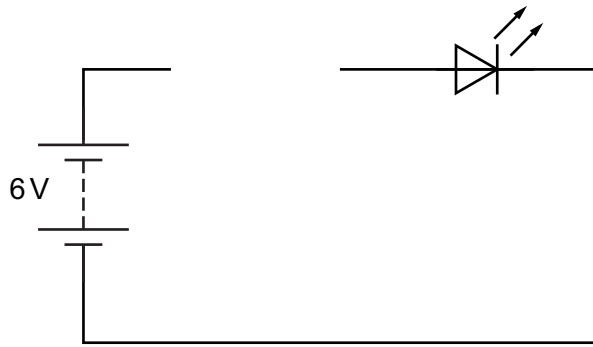


Fig. 1

(a) Complete the circuit diagram in Fig. 1 by drawing a resistor in the space provided. [1]

(b) Calculate the potential difference across the resistor.

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

(c) Give **two** reasons for having a resistor in the LED circuit.

1 .....  
 2 ..... [2]

(d) Describe the operation of an LED.

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

(e) Calculate a suitable value for the resistor if the current flow required is 20 mA.

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

- 3 (a) Complete the table, using a tick (✓) against **three** techniques that can be used to identify potential electrical hazards.

Techniques	Tick (✓)
Portable appliance testing	
Power supply unit	
Truth tables	
Use of residual current device	
Visual inspection of equipment	

[3]

- (b) The half split method is a fault finding procedure for electronic circuits.

Describe how this works.

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

- (c) State **two** benefits of using a virtual signal generator for testing a simulated circuit.

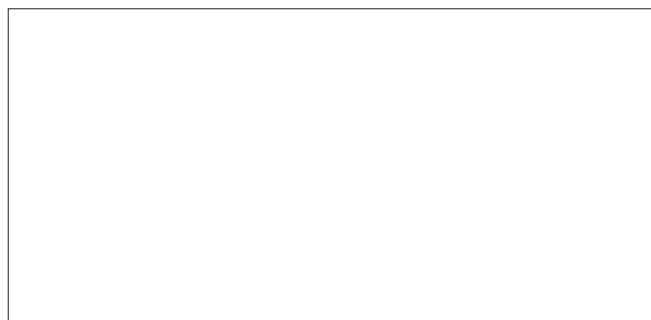
1 .....

.....

2 .....

..... [2]

- (d) In the space provided below, draw the shape of a signal that could be provided by a virtual signal generator.



[2]



5 (a) Identify **two** smart modern materials.

1 .....

2 .....

[2]

(b) Fig. 2 shows part of a circuit diagram for an astable circuit using a 555 timer.

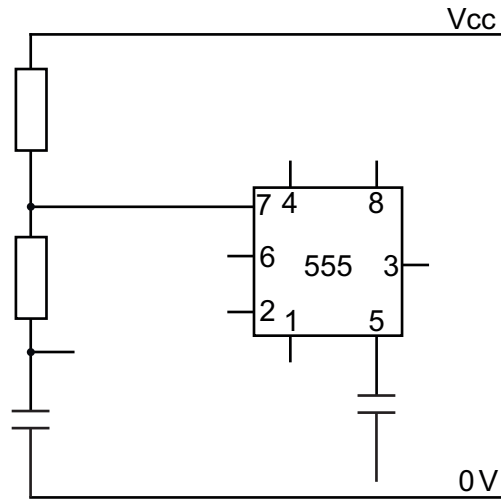


Fig. 2

Complete the circuit diagram in Fig. 2 by drawing in the connections for pins 1, 2, 4, 5, 6, 8. [4]

(c) Draw a label on the circuit diagram in Fig. 2 to show what pin 3 is used for. [1]

(d) Complete the sentence using words from the list below:  
Each word may be used once or not at all.

- external
- internal
- irregular
- regular
- sawtooth
- square

An astable circuit will produce a ..... signal in the form of  
a ..... wave, without needing an ..... trigger. [3]

6 (a) The block diagram in Fig. 3 shows an alarm system for heat and smoke.

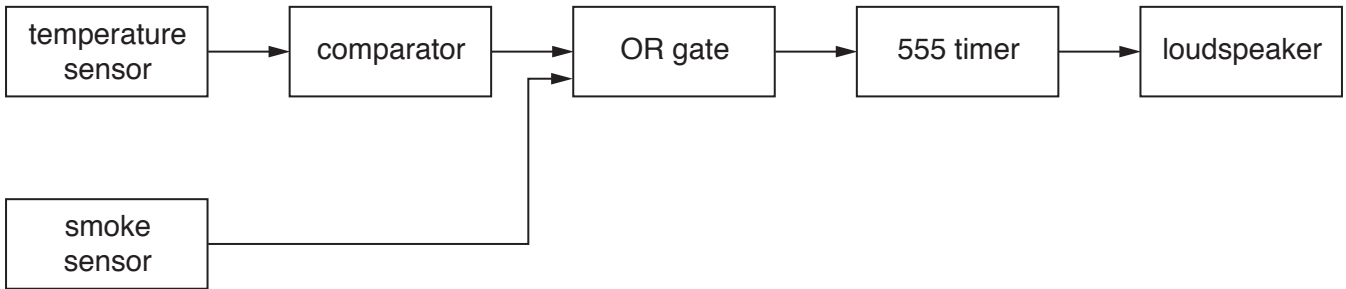


Fig. 3

(i) State the names of the **two** blocks that will give an input to the system.

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

(ii) State which block of the system represents the output stage.

..... [1]

(iii) State in which block an operational amplifier is used.

..... [1]

(iv) State in which block a thermistor is used.

..... [1]

(b) Describe what is meant by the term 'capacitor voltage rating'.

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

(c) Calculate the maximum and minimum value a capacitor will have if it is rated at  $120\ \mu\text{F} \pm 10\%$ .

Maximum value .....

.....

Minimum value .....

..... [3]

END OF QUESTION PAPER

**ADDITIONAL ANSWER SPACE**

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large rectangular area with a solid vertical line on the left side and horizontal dotted lines across the rest of the page, providing space for writing answers.



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