OCR
Oxford Cambridge and RSA

Tuesday 12 January 2021 – Afternoon

Level 1/2 Cambridge National in Systems Control in Engineering

R113/01 Electronic principles

Time allowed: 1 hour

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. 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 **12** pages.

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

OCR is an exempt Charity

Turn over

Answer **all** the questions.

1 Fig. 1 shows a circuit diagram.
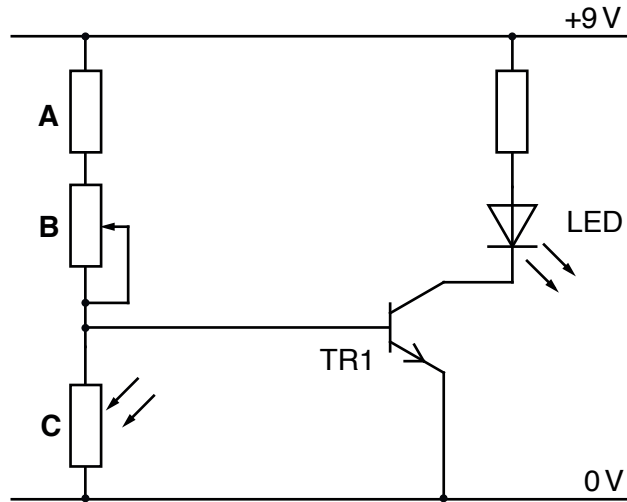
Fig. 1

(a) Name the components **A**, **B** and **C**.

A ....

B ....

C ....

[3]

(b) (i) State the full name of the LED.

L ....   E ....   D ....   **[1]**

(ii) Describe the operating principle of an LED.

....

....

.... **[2]**

(c) State the name of the type of transistor TR1 shown in Fig. 1.

.... **[1]**

(d) Circle **three** of the following components that could replace the LED and resistor as an output in Fig. 1.

bell   photodiode   **Light Dependent Resistor**

buzzer   **signal lamp**   thermistor

[3]

2 Fig. 2 shows an RC series circuit.
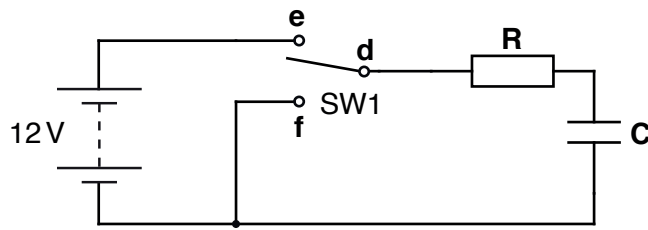
Fig. 2

(a) State which **two** contacts on SW1 must be connected for the capacitor to be charged.

.... [1]

(b) Calculate the initial charging current in amps if **R** is 200 Ω.

....

....

.... [3]

(c) Draw a curve on Fig. 3 to show the potential across capacitor **C** as it is discharging.

Fig. 3

[2]

Turn over

(d) A 10 μF capacitor is to be charged in series with a 0.2 MΩ resistor from a 100 V supply.

Use the formula T = RC to calculate the time constant T.

....

....

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....

....

.... **[4]**

3 **(a)** Two resistors of value 3Ω and 2Ω are connected in parallel to a 12V supply.

(i) Calculate the total circuit resistance.

Use the formula $\dfrac{1}{R_{total}} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$

....

....

....

....

.... **[3]**

(ii) Calculate the power dissipated by the 2Ω resistor.

Use the formula $P = \dfrac{V^2}{R}$

....

....

....

....

.... **[3]**

(b) Fig. 4 shows a potential divider circuit with an output voltage $V_{out} = 2\,V$.

Fig. 4

Calculate the input voltage V_{in} of the circuit.

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....

.... **[4]**

4 (a)* Discuss the function and applications of a signal diode in an electronic circuit.

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.... **[6]**

(b) Fig. 5 shows a control system block diagram.

Fig. 5

State the parts of the control system at **A**, **B**, **C** and **D**.

A ....

B ....

C ....

D ....
[4]

5 (a) Name **two** fault finding procedures other than the truth table method of testing, that can be used on electronic circuits.

1 ....

2 ....

[2]

(b) A technician has used a logic probe to test the logic gates shown in Fig. 6.
Complete the truth table with the result that the technician would expect to get from the test.
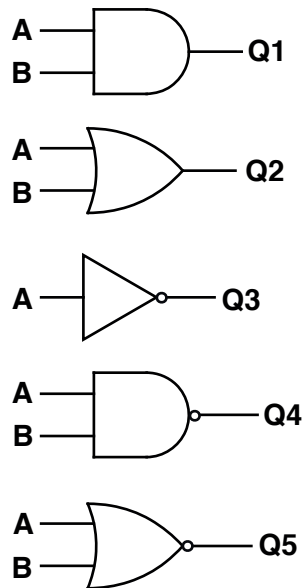
A	B	Q1	Q2	Q3	Q4	Q5
0	0					
0	1					
1	0					
1	1					

Fig. 6

[5]

(c) Fig. 7 shows an industrial plant system using an OR logic gate and two operational amplifiers.

Fig. 7

Explain the function of the OR gate in this system.

....

....

....

....

.... **[3]**

6 (a) Name **two** commercial circuit construction methods other than the use of a pick and place robot.

1 ....

2 ....

[2]

(b) Name **three** functions of a pick and place robot.

1 ....

2 ....

3 ....

[3]

(c) State **five** reasons why components are surface mounted rather than using the through hole system.

1 ....

2 ....

3 ....

4 ....

5 ....

[5]

END OF QUESTION PAPER

11

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).