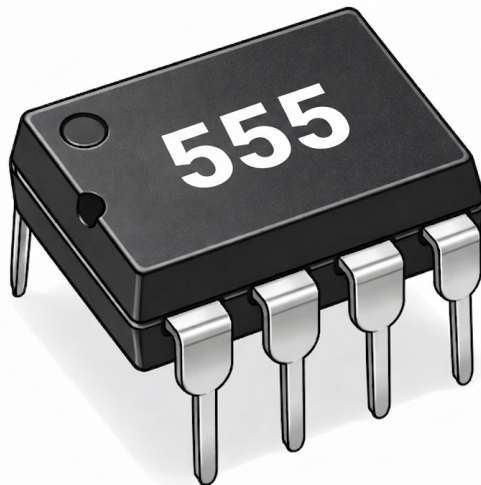


Topic 102 Timing Systems Question Pack

for

Eduqas GCE A-Level Electronics



Student Name:

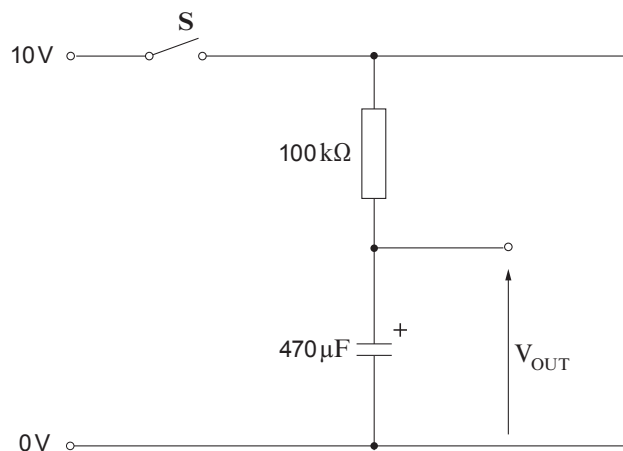
Class / Group:

Question 1

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only

5. The capacitor shown in the following circuit is initially discharged.



- (a) Calculate the time constant of the circuit. [2]

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- (b) Switch S is closed at time $t = 0$.

- (i) Determine the time taken for V_{OUT} to reach 5V. [2]

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- (ii) Calculate the value of V_{OUT} at time $t = 10$ s. [2]

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- (iii) Estimate V_{OUT} after switch S has been closed for 5 minutes. [1]

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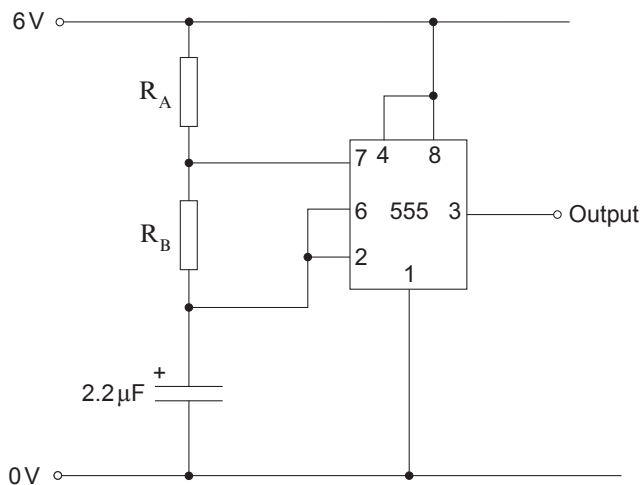
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Question 2

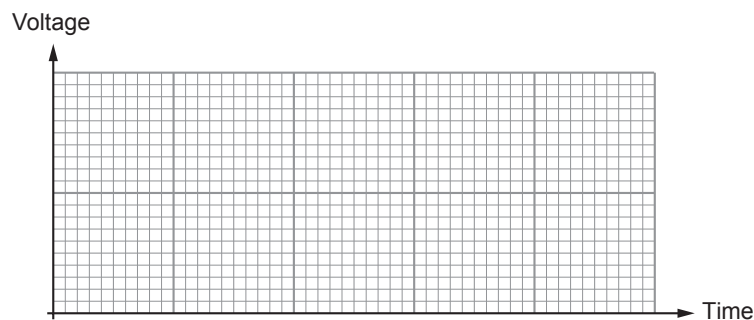
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7. The following diagram shows a 555 timer being used in an astable circuit.



- (a) The output signal has a mark-space ratio of 2:1. Sketch **two** cycles of the output signal. Label the **mark** T_1 and the **space** T_2 . [2]



- (b) The space T_2 has a duration of 20 ms. Calculate the value of resistor R_B that will produce this space when $C = 2.2 \mu\text{F}$. [3]

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- (c) Determine the value of resistor R_A . [1]

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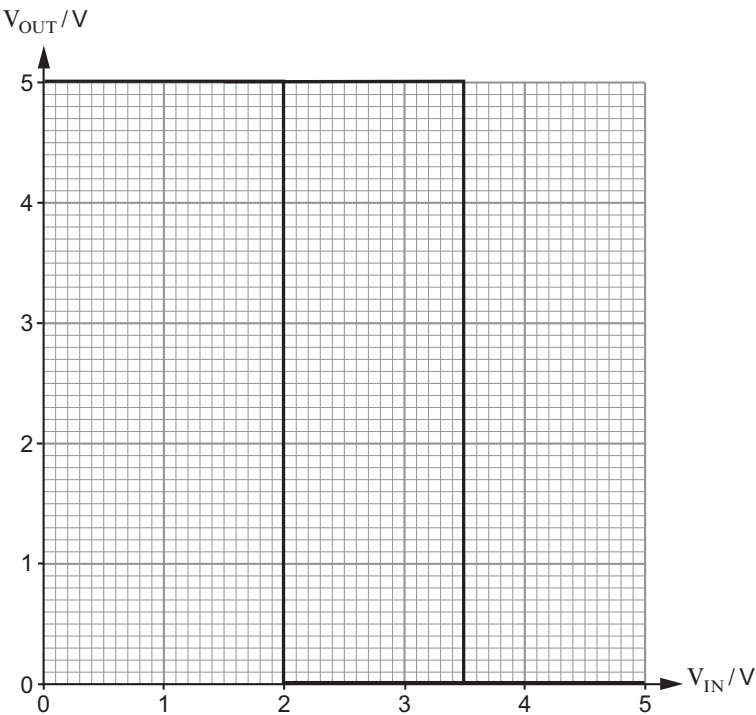
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Question 3

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3. A Schmitt inverter has the following characteristics.

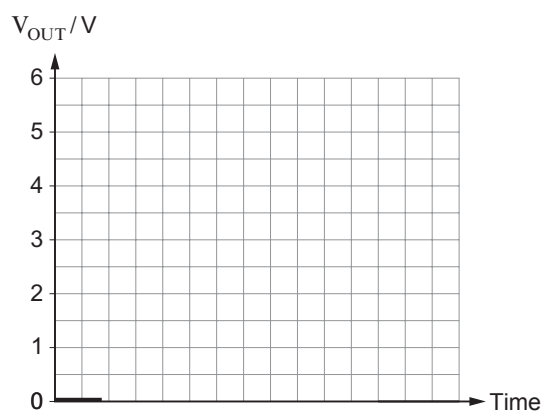
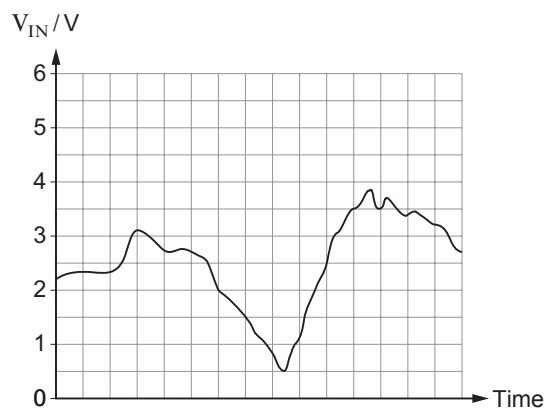


The Schmitt inverter is used to condition the signal produced by a sensing unit.

- (a) Determine the input switching threshold for:
- (i) an increasing input voltage [1]
 - (ii) a decreasing input voltage [1]

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- (b) The signal V_{IN} produced by a sensing unit changes over a period of time. Complete the graph to show the signal V_{OUT} obtained at the output of the Schmitt inverter. [3]

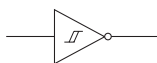
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(c) Another Schmitt inverter is used as part of an astable circuit.

(i) Complete the circuit diagram for the astable circuit.

[2]

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0V ○ _____

(ii) Calculate the values of all components required to produce a frequency of 500 Hz.

[2]

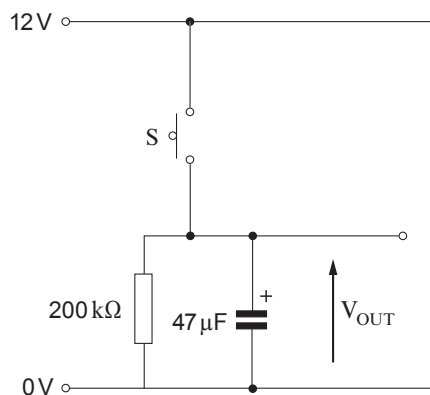
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Question 4

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5. (a) The following diagram shows a timing sub-system used in a monostable circuit.

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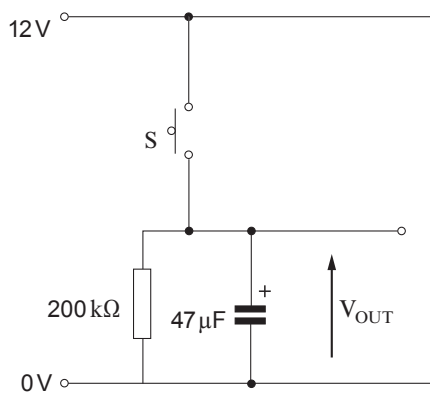
- (i) Switch S is closed and then released at time $t = 0$. Calculate the value of V_{OUT} at time $t = 4$ s. [2]

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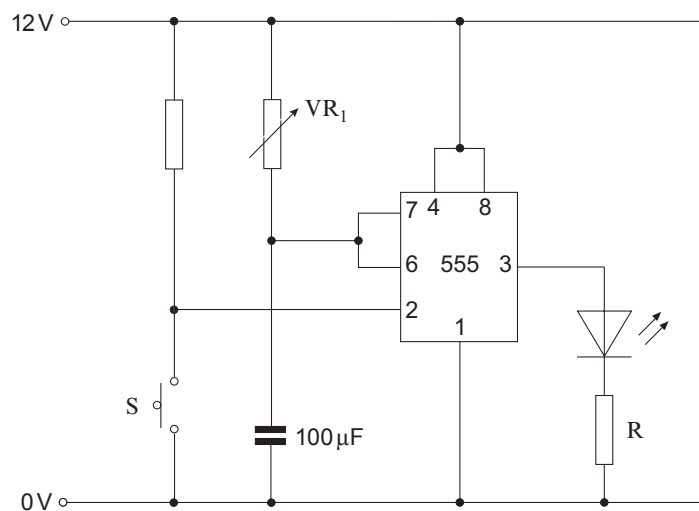
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- (ii) Add a NOT gate and buzzer to the following circuit diagram so that the buzzer comes on for a period of time when switch S is momentarily pressed. [2]



- (b) The following diagram shows another type of monostable circuit based on a 555 timer.



The timing sub-system consists of a $100\mu\text{F}$ capacitor and a variable resistor VR_1 . Calculate the resistance of VR_1 so that a blue LED stays on for one minute after the switch S is momentarily pressed. [2]

- (c) When the monostable is activated, the output voltage is 12V. The forward voltage drop across the blue LED is 3.6V.

- (i) Calculate the value of resistor R that limits the current through the LED to a maximum of 30 mA. [2]

- (ii) Determine a suitable preferred value for R. [1]

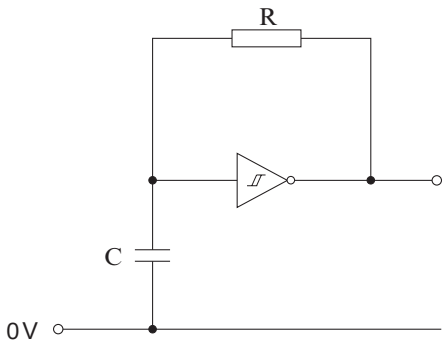
Question 5

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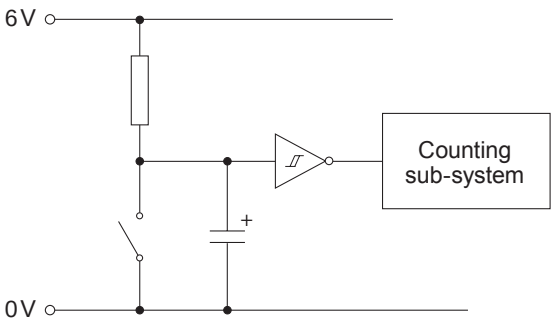
2. Schmitt inverters are used in many applications of electronics.

(a) (i) What is the name of the Schmitt inverter application shown in the circuit diagram?



Application: [1]

(ii) What is the purpose of the capacitor and Schmitt inverter in the counting system shown?



Purpose: [1]

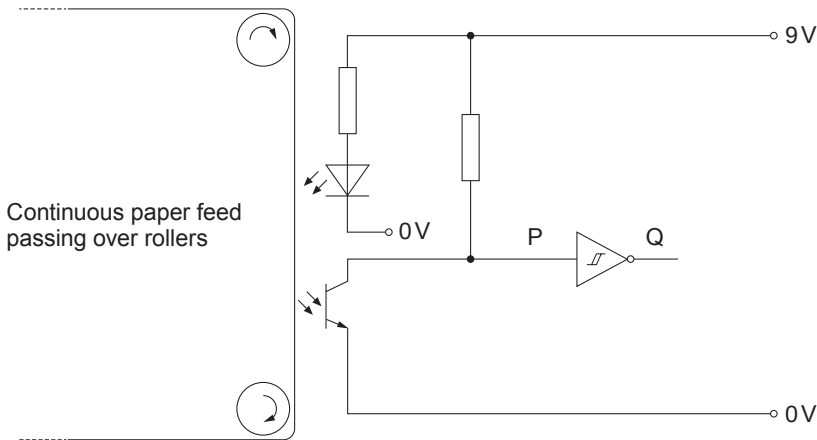
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(b) Another application for a Schmitt trigger is shown below.

A continuous paper feed system uses a phototransistor and Schmitt inverter to check for the presence of paper.



(i) What is the purpose of the Schmitt inverter in this system? [1]

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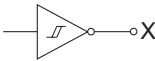
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(ii) State whether the logic levels at P and Q are high or low when paper is present. [1]

P = ... Q = ...

(c) A temperature sensing sub-system should be connected to the input of a Schmitt inverter. Add any components necessary such that the output, X, changes from logic 0 to logic 1 when the temperature drops below a certain value. [2]

5V ○



0V ○

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