Surname		Other Names	
Centre Number			Candidate Number									
Candidate Signature												

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General Certificate of Secondary Education
June 2006

ELECTRONICS **3432/F**
Written Paper
Foundation Tier **F**

Thursday 25 May 2006 1.30 pm to 3.00 pm

For this paper you must have:
- a pencil and ruler
- a calculator

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Show the working of your calculations.

Information
- The maximum mark for this paper is 120.
- The marks for questions are shown in brackets.
- A list of formulae and other information, which you may wish to use in your answers, is provided on page 2.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use			
Number	Mark	Number	Mark
1		9	
2			
3			
4			
5			
6			
7			
8			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

Information Sheet

The following information may be useful in answering the questions.

1. **Power**
   Power = voltage x current; $P = VI$

2. **Amplifiers**
   Voltage gain $G_v = \frac{V_{out}}{V_{in}}$

3. **Resistor colour code**
   The colours in the resistor colour code correspond to the following values.

BLACK	0	GREEN	5
BROWN	1	BLUE	6
RED	2	VIOLET	7
ORANGE	3	GREY	8
YELLOW	4	WHITE	9

   The fourth band colour gives the tolerance.
   GOLD ± 5% SILVER ± 10% No fourth band ± 20%

4. **Resistor printed code** (BS 1852)
   R means x 1
   K means x 1000
   M means x 1 000 000
   Position of letter gives the decimal point.
   Tolerances are indicated by adding a letter at the end.
   J ± 5% K ± 10% M ± 20%
   e.g. 5K6J = 5.6 kΩ ± 5%

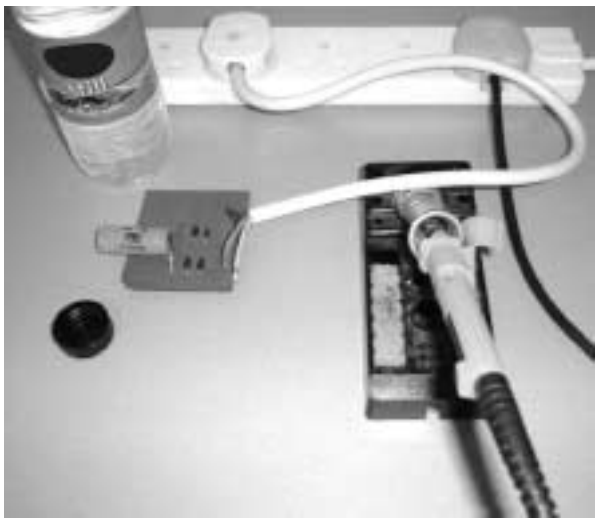
5. **Preferred values for resistors** (E24 SERIES)
   1.0 1.1 1.2 1.3 1.5 1.6 1.8 2.0 2.2 2.4 2.7 3.0 3.3 3.6 3.9 4.3 4.7 5.1 5.6 6.2 6.8 7.5 8.2 9.1 and multiples of ten.

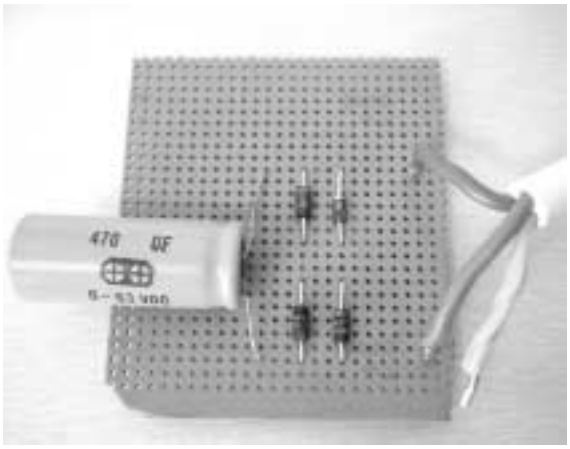
6. Resistance $= \frac{\text{voltage}}{\text{current}}$; $R = \frac{V}{I}$

7. Effective resistance, R, of resistors in series is given by
   $R = R_1 + R_2 + R_3$.

Answer **all** questions in the spaces provided.

1 A student goes into an electronics workshop alone after school to repair an electronic circuit. The workbench and the circuit are shown below.





(a) State **five** dangers in this situation.

1 .....

2 .....

3 .....

4 .....

5 .....

(5 marks)

(b) The student touches the live wire of the mains supply.
State **two** different effects this will have on the student.

1 .....

2 .....

(2 marks)

(c) You discover the student after this has happened.
Give **three** steps you would take to help the student.

1 .....

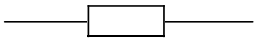
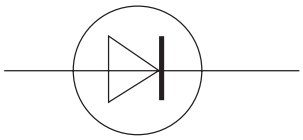
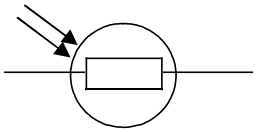
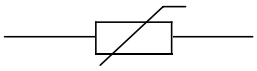
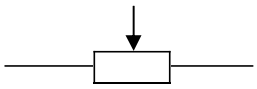
2 .....

3 .....

(3 marks)

Turn over ▶

2 (a) Name the circuit symbols shown below.

Symbol	Name
	
	
	
	
	

(5 marks)

(b) Complete the following sentences about transducers.

(i) An output transducer that converts electrical energy into sound energy is a ..... .

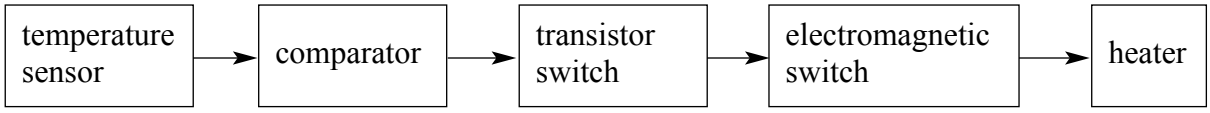
(ii) An input transducer that converts sound energy into electrical energy is a ..... .

(iii) An LED is an ..... transducer that converts ..... energy into ..... energy.

(5 marks)

10

3 A block diagram of an electronic temperature control system is shown below.



(a) Which block represents

(i) an input, ...

(ii) an output, ...

(iii) an analogue to digital converter? .....

(3 marks)

(b) In which block could

(i) an op-amp be found, ……...

(ii) a thermistor be found? ……

(2 marks)

(c) Which **two** blocks use a small current to control a larger current?

1 .....

2 .....

(2 marks)

(d) Describe **three** actions of this system when the temperature drops below the set level.

1 .....

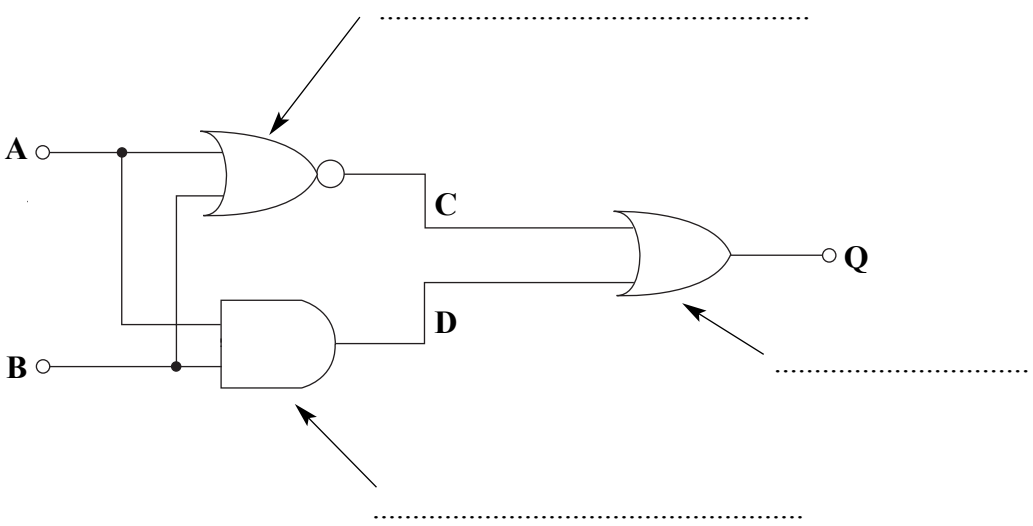
2 .....

3 .....

(3 marks)

10

4 (a) Label the **three** different types of logic gate in the circuit below.



(3 marks)

(b) Complete the truth table below to describe the operation of the logic circuit.

A	B	C	D	Q
0	0			
0	1			
1	0			
1	1			

(4 marks)

(c) Logic input **A** is connected to a door switch that gives logic 0 when open and logic 1 when closed. Logic input **B** is connected to a heat sensor that gives logic 0 when cold and logic 1 when warm.

Describe the **two** sets of conditions that would cause **Q** to give logic 1.

1 ..... and .....

2 ..... and .....

(2 marks)

(d) How could the circuit be changed so that the logic values of the output **Q** are reversed?

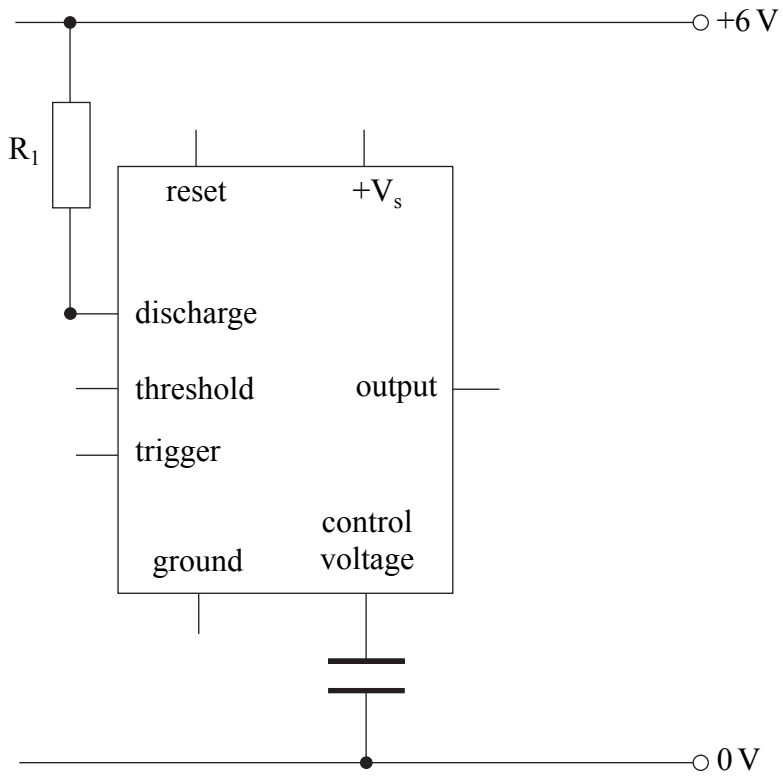
.....

(1 mark)

10

5 A 555 timer IC is used to make an astable.

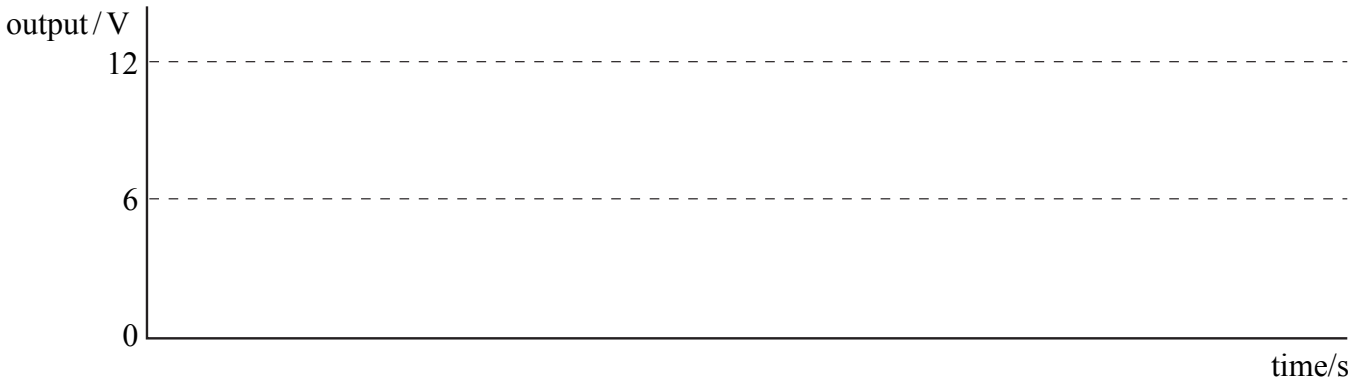
(a) Complete the circuit diagram of the astable below. Add wire links, draw and label the timing resistor R_2 and the timing capacitor C.



(6 marks)

(b) The astable above operates on a supply voltage of 6 V.

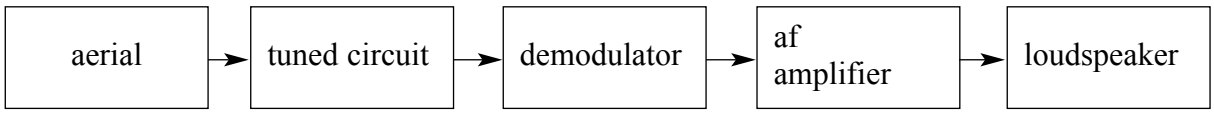
Draw on the axes below a typical output signal from this circuit.



(4 marks)

10

6 A block diagram of a simple radio receiver system is shown below.



(a) Complete these sentences to describe the function of each of the following sub-systems.

(i) The aerial converts .....

into ..... .

(ii) The tuned circuit .....

..... .

(iii) The demodulator converts .....

into ..... .

(6 marks)

(b) The audio frequency amplifier can be made using an audio amplifier IC.
What does this type of IC do to the audio frequency signal?

Choose from: **decreases** **does not change** **increases**

Select from the list above and use your answer to complete the sentences which follow.
You may use each answer once, more than once, or not at all.

(i) The signal voltage..... .

(ii) The signal current ..... .

(iii) The signal frequency..... .

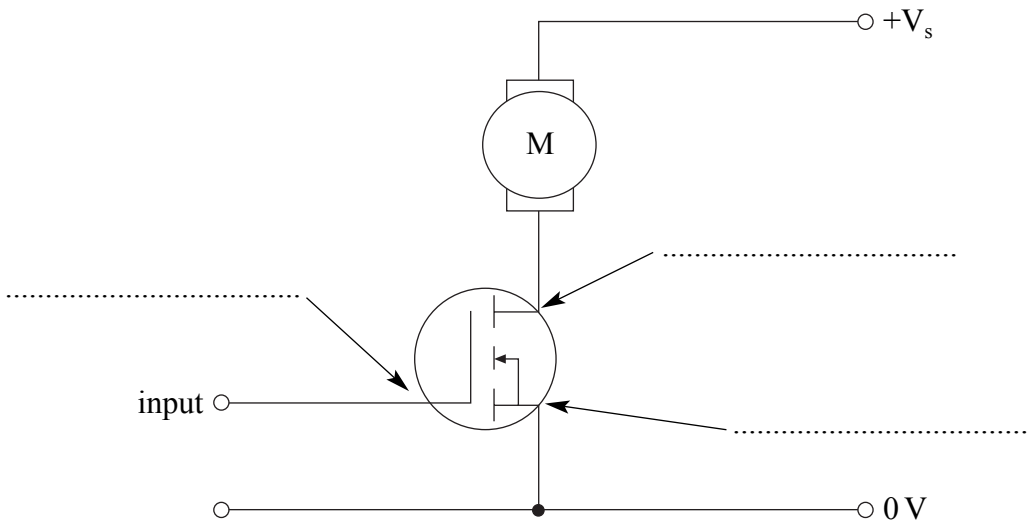
(iv) The signal power ..... .

(4 marks)

10

7 A MOSFET is used to switch current to an electric motor.

(a) Label the leads of the MOSFET on the circuit diagram below.



(3 marks)

(b) Another component is required to protect the MOSFET when the motor switches off. Draw this component, in the correct location, on to the diagram above.

(3 marks)

(c) Give a reason why an input resistor is **not** needed in this circuit.

.....

(1 mark)

(d) The motor current is 10 A. Why is a MOSFET a better choice for the switching function than a bipolar transistor?

.....

(1 mark)

(e) For which of the following input voltages will the motor be:

Choose from: **0 V**, **1 V**, **2 V**, **3 V** or **5 V**

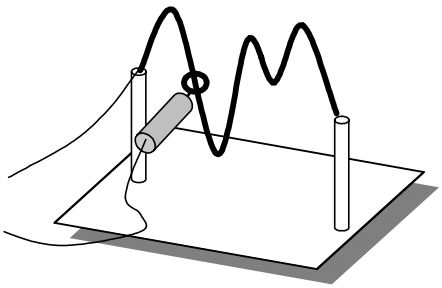
(i) completely off, ...

(ii) fully on? .....

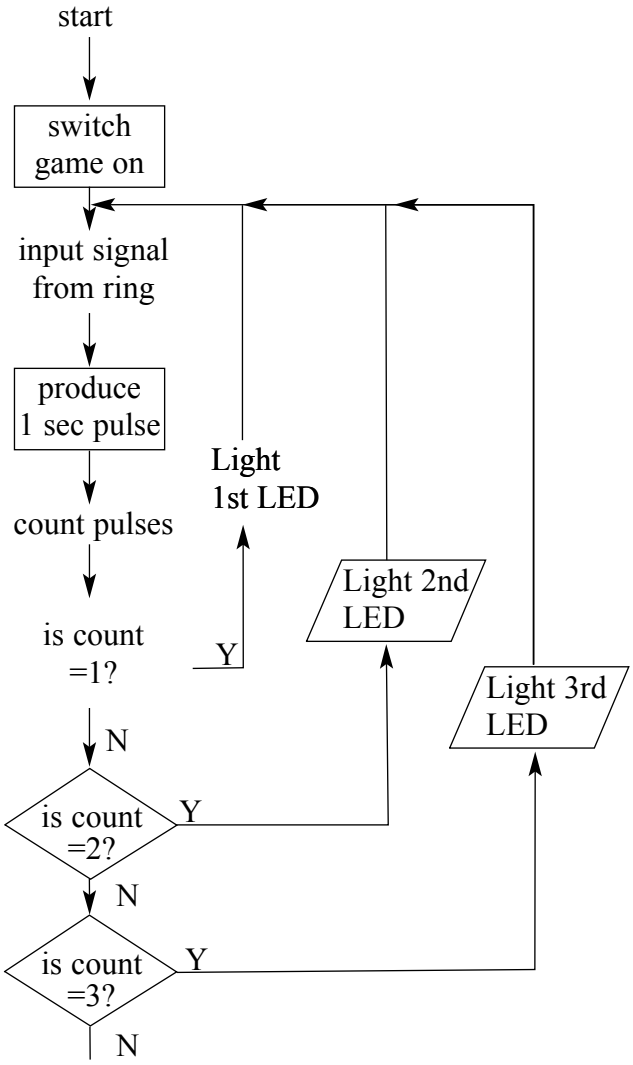
(2 marks)

10

8 The diagram below shows a bent wire game, where a contestant tries to pass a metal ring over a bent wire track without touching it.



The flowchart describes what happens when the ring touches the wire for the first, second, and third time. Each time the ring touches the wire, a 1 second pulse is produced and the number of touches is shown by three green LEDs.



(a) Draw the correct flowchart symbols at **five** places where they are missing above.

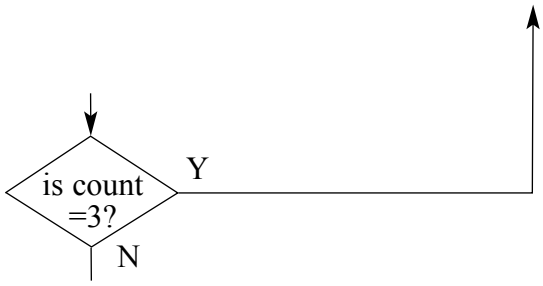
(5 marks)

(b) Label on the flowchart:

a decision box, an input box, a loop, an output box and a process box

(5 marks)

(c) The action of the bent wire game continues after the third touch.
The fourth touch makes a yellow LED flash on and off as a warning sign that the contestant has no more chances. The fifth touch makes a red LED flash on and off and a buzzer sound to mark the end of the game.
Draw a flowchart for this part of the game, to follow on from the flowchart on **page 10**. Use that flowchart to help you. The lower part of that flowchart is drawn here; start your flowchart from it.



(10 marks)

20

9 A student decides to construct a bent wire game similar to that described in **Question 8**.

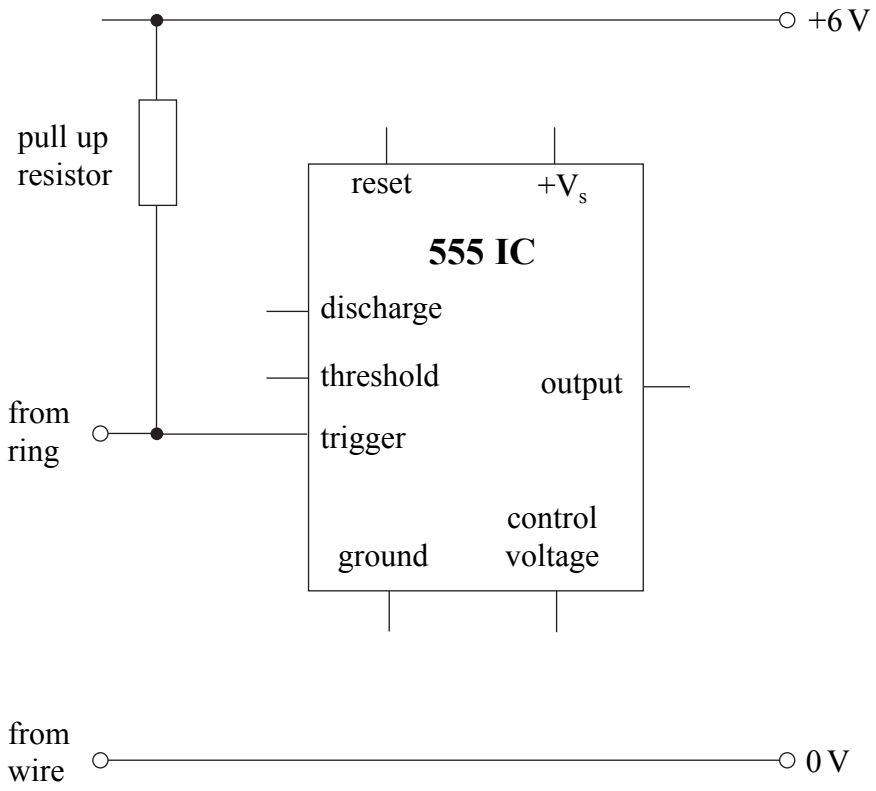
It is not necessary to have completed your answer to Question 8 before attempting this question.

The bent wire and the ring form the input sub-system which triggers a 555 IC monostable circuit when the ring touches the wire. A 4017 counter IC counts the pulses from the monostable and provides outputs to switch the LEDs, and also a buzzer which sounds only when the ring touches the wire for a fifth time.

(a) Draw a system block diagram to show how all the sub-systems should be connected.

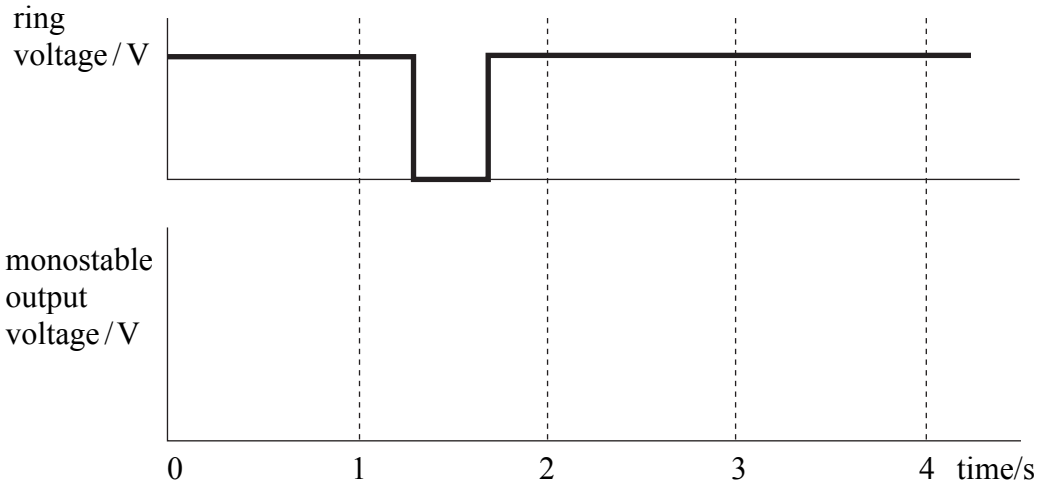
(5 marks)

(b) Complete the circuit diagram below to show how the 555 IC should be connected to form the monostable. Include a timing resistor and capacitor, any other components needed and label the connection that goes to the counter.



(8 marks)

(c) (i) Complete the timing diagram below to show the output voltage from the monostable during the time interval shown. The monostable has a period of 1 second.



(ii) What component in the monostable circuit keeps the trigger voltage high when the ring is not touching the wire?

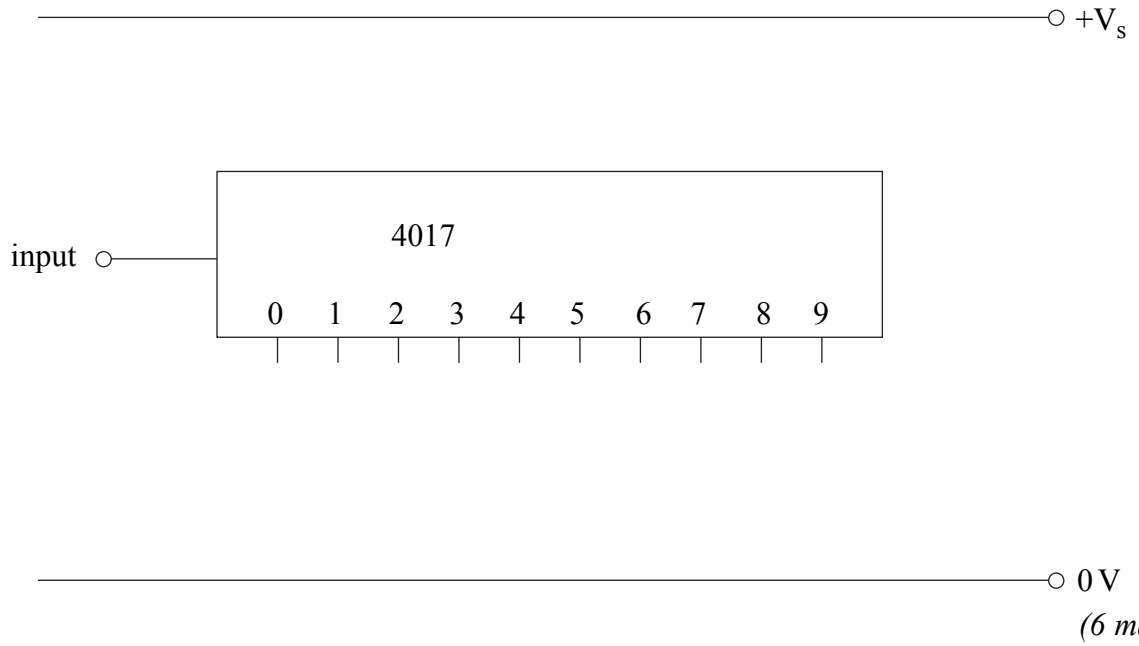
.....

(iii) What action forces the trigger voltage to go low?

.....

(6 marks)

(d) Add to the counter circuit diagram below **three** LEDs and their series resistors that would indicate the first three pulses from the monostable.



(6 marks)

Question 9 continues on the next page

(e) What extra sub-system is required to make an LED flash on and off?

.....

(1 mark)

(f) The 4017 IC can supply a current of 10 mA to each output, and is connected to a 9 V battery. The LEDs have a forward voltage of 2 V.

(i) Calculate the voltage drop across the LED current limiting resistor.

.....

(ii) Calculate the required resistance of the LED current limiting resistor.

.....

(iii) State which resistor from the E24 range would be suitable if the current limit is not to be exceeded.

.....

(4 marks)

30

END OF QUESTIONS

There are no questions printed on this page

There are no questions printed on this page