



L-Università
ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE
EXAMINATIONS BOARD

**SECONDARY EDUCATION CERTIFICATE LEVEL
2022 SUPPLEMENTARY SESSION**

SUBJECT: **Engineering Technology**
PAPER NUMBER: Synoptic – Unit 2
DATE: 1st November 2022
TIME: 11:30 a.m. to 1:35 p.m.

**THIS PAPER SHOULD BE RETURNED TO THE INVIGILATOR
AFTER THE EXAMINATION.**

For examiners' use only:

Question	1	2	3	4	5	6	7	8	Total
Score									
Maximum	6	12	8	8	8	8	12	8	70

Answer **ALL** questions in the space provided. The use of non-programmable electronic calculators is allowed.

Scenario

- An engineering company issued a call for applications for electronic technicians.
- The applicants were given the following test to assess their knowledge in electronic circuit design.

Question 1

K-1 (6 marks)

a. Categorise the following materials as insulators or conductors by filling in Table 1 below.

Copper	Rubber	Wood	Bronze
Porcelain	Oil	Silver	Steel

Table 1: Conductors or Insulators.

Conductors	Insulators

(2)

b. Define the term semi-conductor.

(2)

c. One of the technicians measured the resistance of two wires made up of the same material. He noted that the resistance is different in each case. State the **TWO** parameters affecting the resistance of the wires.

Parameter 1:

(1)

Parameter 2:

(1)

6

Question 2

C-1 (12 marks)

- a. Describe the relationship between resistance, voltage and current. Write down the equation and the SI unit for each parameter.

(4)

- b. Figure 1 shows the measurements of current and voltage across a resistor. Determine the resistance from the given VI graph. Show all your workings.

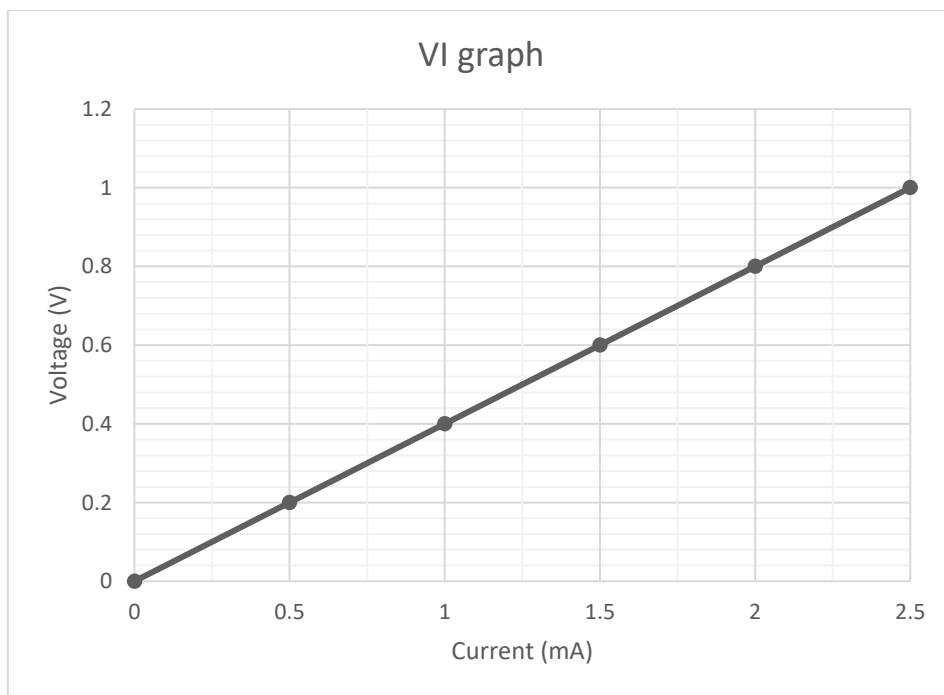


Figure 1: VI graph of an ohmic component

(4)

- c. Calculate the value of R1 for the circuit shown in Figure 2 given that the LED requires 2V and 20mA. Show all your workings.

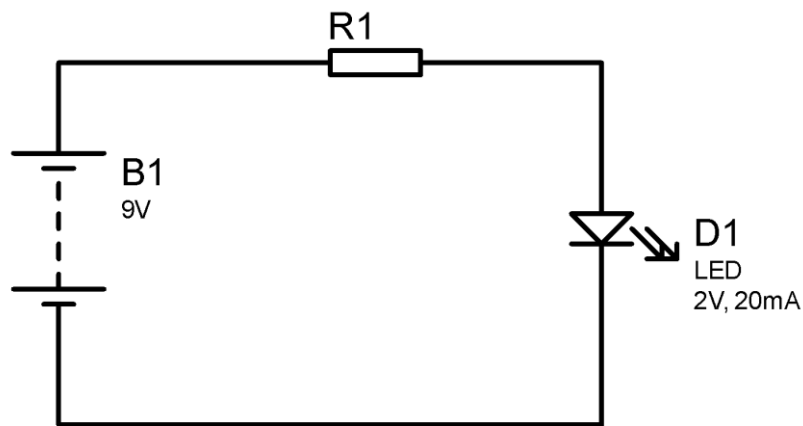


Figure 2: Circuit 2

(4)

12

Question 3

K-3 (8 marks)

a. Figure 3 shows an open and a closed circuit. Differentiate (by showing the difference) between the two circuits and the operation of both circuits.

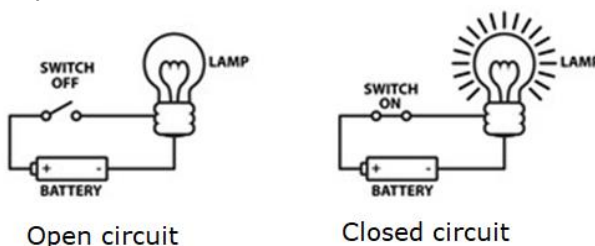


Figure 3: Open and closed circuit
(Source: shutterstock.com)

Difference:

_____ (2)

b. A battery is used to power **TWO** light bulbs connected in parallel when their respective switches are closed (switch connected in series with each light bulb). Draw the described circuit in the space provided.

(2)

c. Identify (by marking and labelling) **ONE** series and **ONE** parallel sub-circuits from the circuit given in Figure 4 below.

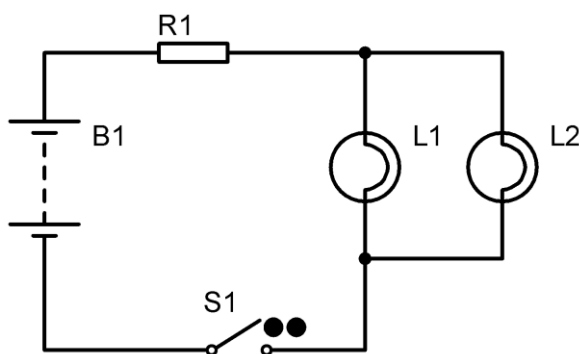


Figure 4: Circuit 1





(4) 8

Question 4

K-4 (8 marks)

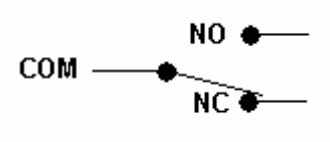

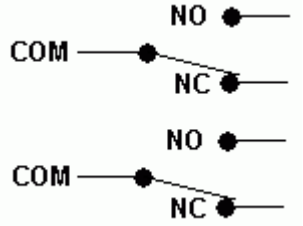

a. Identify the different designs of switches given in Table 2 below.

Table 2: Different designs of switches.

	Switch	Name of Switch
i.	 <p>(Source: shutterstock.com)</p>	<p>_____</p> <p>(0.5)</p>
ii.	 <p>(Source: https://www.ubuy.com.tr/)</p>	<p>_____</p> <p>(0.5)</p>
iii.	 <p>(Source: https://www.etek-china.com/)</p>	<p>_____</p> <p>(0.5)</p>
iv.	 <p>(Source: shutterstock.com)</p>	<p>_____</p> <p>(0.5)</p>

b. Identify the different types of switches from their schematics in terms of poles and throws, shown in Table 3.

Table 3: Different types of switches.

	Schematic symbol	Type of Switch
i.		_____ (0.5)
ii.		_____ (0.5)
iii.		_____ (0.5)
iv.		_____ (0.5)

(Source: <https://reviseomatic.org/help/e-switches/Switches.php>)

c. Select the appropriate switch for the two scenarios given below. Each scenario requires a different type of switch.

i. Select a switch for a doorbell. The bell is normally off and sounds only when the switch is pressed.

_____ (2)

ii. Select a switch to power on or off the light bulbs of a staircase from two locations (top and bottom of staircase).

_____ (2)

8


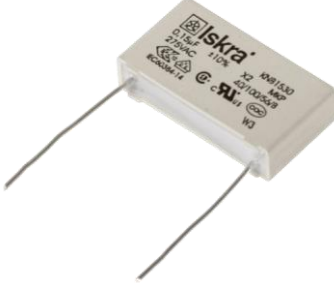
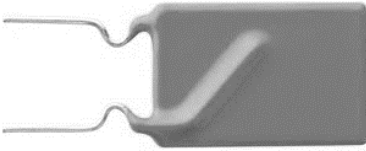
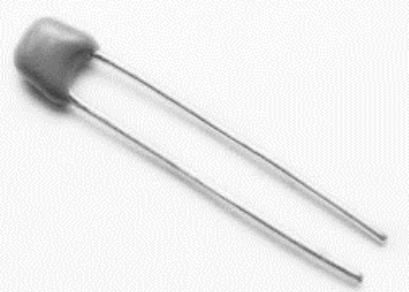
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Question 5

K-5 (8 marks)

a. Identify the different types of capacitors provided in Table 4.

Table 4: Different types of capacitors.

	Picture of Capacitor	Name the type of capacitor
i.		<p>_____</p> <p style="text-align: right;">(0.5)</p>
ii.		<p>_____</p> <p style="text-align: right;">(0.5)</p>
iii.		<p>_____</p> <p style="text-align: right;">(0.5)</p>
iv.		<p>_____</p> <p style="text-align: right;">(0.5)</p>

(Source: shutterstock.com)

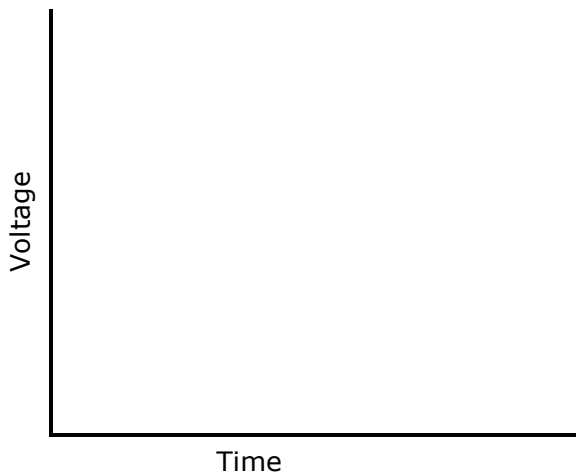
b. Rank the given values of capacitors in order, starting from the smallest to the largest value.

$56mF$, $330pF$, $0.0005mF$, $100\mu F$, $22\eta F$

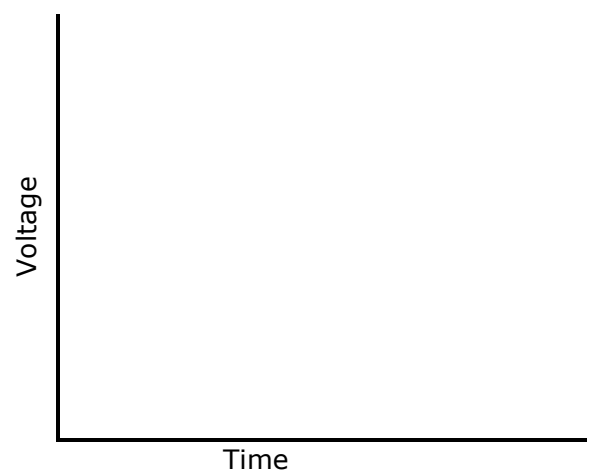
- i. Smallest: _____ (0.4)
- ii. _____ (0.4)
- iii. _____ (0.4)
- iv. _____ (0.4)
- v. Largest: _____ (0.4)

c. On the graphs provided, sketch the voltage-time graphs of a charging and discharging capacitor.

Charging



Discharging



(4) 8

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Question 6

K-7 (8 marks)

a. List **TWO** different types of analogue devices.

Analogue device 1: _____ (1)

Analogue device 2: _____ (1)

b. List the characteristics of the analogue devices given below by answering the following questions:



Figure 5: Analogue Device
(Source: google.com)

i. Name one semi-conductor material used for the analogue device in Figure 5:

_____ (0.5)

ii. List the name of Lead A and Lead B in Figure 5.

Lead A: _____ (0.25)

Lead B: _____ (0.25)

iii. List whether the analogue device in Figure 6 is an NPN or a PNP. _____ (0.5)

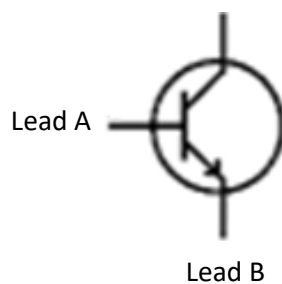


Figure 6: Analogue Device

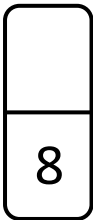
iv. List the name of Lead A and Lead B in Figure 6.

Lead A: _____ (0.25)

Lead B: _____ (0.25)

c. Describe the function of the analogue device in Figure 5 and the analogue device in Figure 6.

_____ (4)



Please turn the page.

Question 7

C-4 (12 marks)

- a. List **FOUR** different types of logic gates and their respective symbols. Write your answer in the respective column in Table 5. (4)
- b. Write the truth tables of the **FOUR** logic gates selected in question 7(a). Write your answer in the respective column in Table 5. (4)

Table 5: Logic Gates.

	Name of Logic Gate	Symbol	Truth Table																	
i.			<table border="1"> <thead> <tr> <th>Input 1</th> <th>Input 2</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td></td> </tr> <tr> <td>0</td> <td>1</td> <td></td> </tr> <tr> <td>1</td> <td>0</td> <td></td> </tr> <tr> <td>1</td> <td>1</td> <td></td> </tr> </tbody> </table>	Input 1	Input 2	Output	0	0		0	1		1	0		1	1			
Input 1	Input 2	Output																		
0	0																			
0	1																			
1	0																			
1	1																			
ii.			<table border="1"> <thead> <tr> <th>Input 1</th> <th>Input 2</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td></td> </tr> <tr> <td>0</td> <td>1</td> <td></td> </tr> <tr> <td>1</td> <td>0</td> <td></td> </tr> <tr> <td>1</td> <td>1</td> <td></td> </tr> </tbody> </table>	Input 1	Input 2	Output	0	0		0	1		1	0		1	1			
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Input 1	Input 2	Output																		
0	0																			
0	1																			
1	0																			
1	1																			

iv.			Input 1	Input 2	Output
			0	0	
			0	1	
			1	0	
			1	1	

c. Determine the output of the multi-stage circuit shown in Figure 7. Show all your working in the truth table given below.

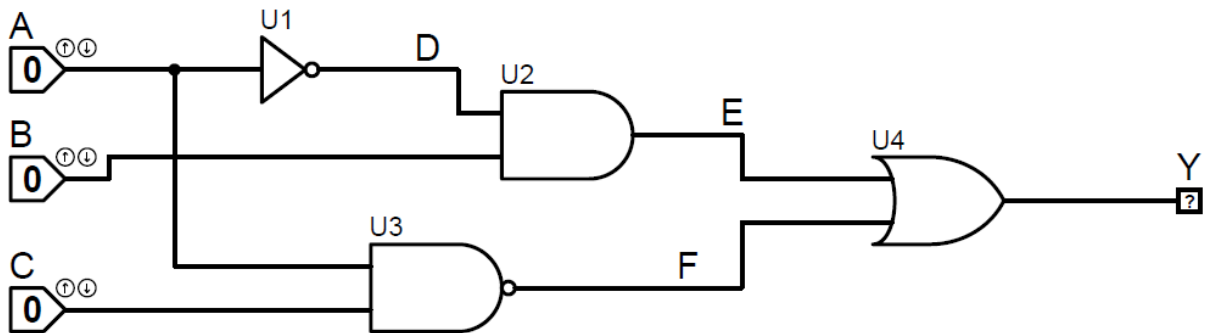


Figure 7: Circuit 3

Table 6: Truth table

A	B	C	D	E	F	Y
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				

12

(4)






Please turn the page.

Question 8

K-10 (8 marks)

a. Label the following tools used in electronic circuit construction given in Table 7.

Table 7: Tools for circuit construction.

	Tools	Name of tool
i.		<p>_____</p> <p>(0.4)</p>
ii.		<p>_____</p> <p>(0.4)</p>
iii.		<p>_____</p> <p>(0.4)</p>
iv.		<p>_____</p> <p>(0.4)</p>
v.		<p>_____</p> <p>(0.4)</p>

(Source: shutterstock.com)

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