Index Number:_____ SEC37/s2.21s

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SECONDARY EDUCATION CERTIFICATE LEVEL
2021 SUPPLEMENTARY SESSION

SUBJECT:	**Engineering Technology**
PAPER NUMBER:	Synoptic – Unit 2
DATE:	3rd November 2021
TIME:	4:00 p.m. to 6:05 p.m.

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

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

Scenario

- An engineering company which specialises in manufacturing integrated circuits has a vacancy for a technician.
- As part of the selection process, applicants are given the following test to assess their knowledge in electronics and demonstrate that they are suitable for the job.

Question 1 **K-1 (6 marks)**

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

Aluminium	Brass	Ceramic	Glass	Gold
Iron	Paper	Plastic	Steel	Wood

Table 1 – Conductors or Insulators.

Conductors	**Insulators**

(2)

b. Define the term semi-conductor.

_____

_____

_____

_____

_____ (2)

c. State **TWO** parameters affecting resistance of a material.

_____

_____

_____

_____

_____ (2)

Question 2 **K-4 (8 marks)**

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

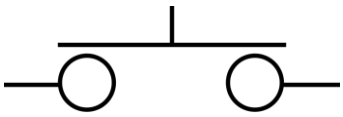
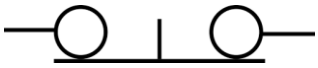
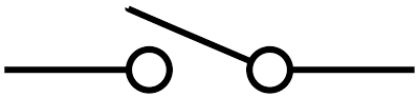
Table 2 – Different designs of switches.

	Switch	**Name of Switch**
i.	 *Source: https://www.google.com/*	_____ (0.5)
ii.	 *Source: https://www.google.com/*	_____ (0.5)
iii.	 *Source: https://www.google.com/*	_____ (0.5)
iv.	 *Source: https://www.google.com/*	_____ (0.5)

This question continues on next page.

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.	 *Source: https://www.google.com/*	_____ (0.5)
ii.	 *Source: https://www.google.com/*	_____ (0.5)
iii.	 *Source: https://www.google.com/*	_____ (0.5)
iv.	 *Source: https://www.google.com/*	_____ (0.5)

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

i. Select a switch for an emergency button in a classroom. The electricity in the classroom is normally on. During an emergency, the switch is pressed to stop the flow of electricity.

_____ (2)

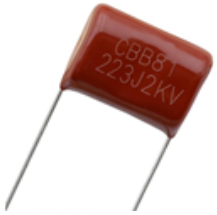
ii. Select a switch which turns the power of a wireless mouse on or off.

_____ (2)

Question 3 **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.	 *Source: https://www.google.com/*	_____ (0.5)
ii.	 *Source: https://www.google.com/*	_____ (0.5)
iii.	 *Source: https://www.google.com/*	_____ (0.5)
iv.	 *Source: https://www.google.com/*	_____ (0.5)

This question continues on next page.

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

$47000\eta F,\quad 33000pF,\quad 220\mu F,\quad 1000\mu F,\quad 15\eta F,\quad 47000\eta F,\quad 1\mu F,\quad 100\eta F,\quad 20pF$

i. Smallest: _____ (0.25)

ii. _____ (0.25)

iii. _____ (0.25)

iv. _____ (0.25)

v. _____ (0.25)

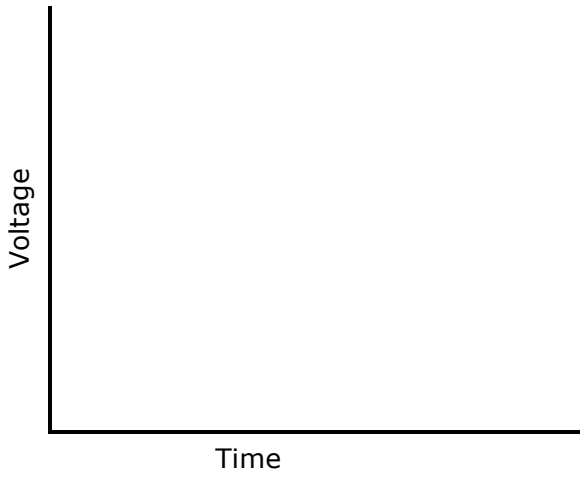
vi. _____ (0.25)

vii. _____ (0.25)

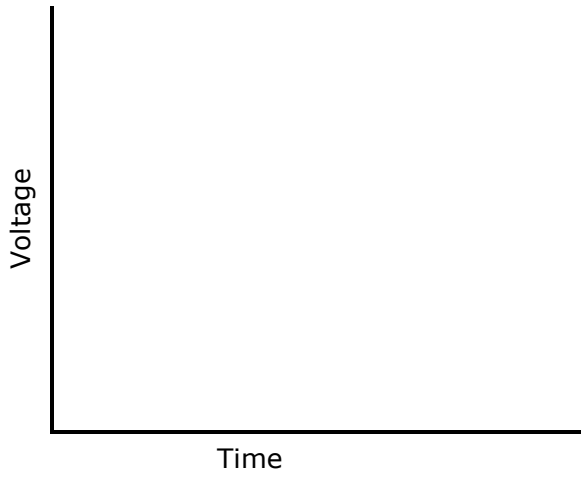
viii. Largest: _____ (0.25)

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

Charging



Discharging



(4)

Question 4 **K-7 (8 marks)**

a. List **TWO** analogue devices.

Analogue Device 1: _____ (1)

Analogue Device 2: _____ (1)

b. i. List **ONE** semiconductor material which is used in the component of Figure 1.

_____ (0.4)

ii. List the name of lead a and lead b.

b. _____

a. _____

Figure 1

(0.4)

iii. List **ONE** semiconductor material which is used in the component in Figure 2.

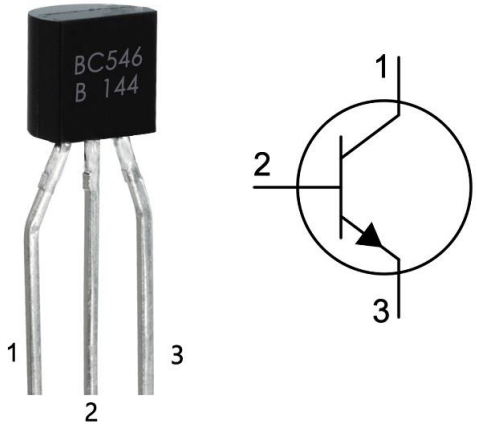


Figure 2

_____ (0.4)

This question continues on next page.

iv. List the names of the **THREE** leads of the component shown in Figure 2.

Component lead 1: _____

Component lead 2: _____

Component lead 3: _____ (0.6)

vi. The material inside the component can be constructed in two ways. List **ONE** of them.

_____ (0.2)

c. Describe the function of the analogue devices listed in Question 4a.

_____

_____

_____

_____

_____

_____

_____

_____

_____

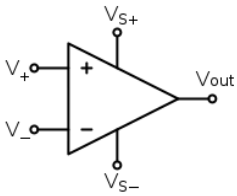
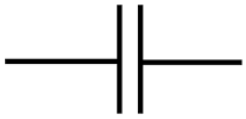
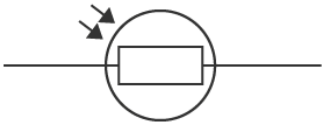
_____

_____ (4)

Question 5 **K-9 (8 marks)**

a. Identify the electronic symbols given in Table 5 below.

Table 5 – Electronic symbols.

	Symbols	Name of electronic component
i.	 *Source: https://www.google.com/*	_____ (0.4)
ii.	 *Source: https://www.google.com/*	_____ (0.4)
iii.	 *Source: https://www.google.com/*	_____ (0.4)
iv.	 *Source: https://www.google.com/*	_____ (0.4)
v.	 *Source: https://www.google.com/*	_____ (0.4)

This question continues on next page.

b. Match the SI units to their respective parameters by drawing a line between Column A and Column B.

Column A (SI Unit)	**Column A (Parameter)**
Amps	Capacitance
Farads	Current
Volts	Power
Ohms	Voltage
Watts	Resistance

(2)

c. Identify different packaging of the following electronic components by underlining the correct answer under the given component.

Capacitor	 *Source: https://www.google.com/* Radial or Axial	 *Source: https://www.google.com/* Radial or Axial
Resistor	 *Source: https://www.google.com/* Through hole or Surface Mount	 *Source: https://www.google.com/* Through hole or Surface Mount

(4)

Question 6 **K-10 (8 marks)**

a. Label the different tools used in electronic circuit construction given in Table 6.

Table 6 – Tools for circuit construction.

	Tools	Name of tool
i.	 *Source: https://www.google.com/*	_____ (0.4)
ii.	 *Source: https://www.google.com/*	_____ (0.4)
iii.	 *Source: https://www.google.com/*	_____ (0.4)
iv.	 *Source: https://www.google.com/*	_____ (0.4)
v.	 *Source: https://www.google.com/*	_____ (0.4)

b. Identify by numbering the **FIVE** steps for correct use of a soldering iron effectively.

Step:	Allow the solder joint to solidify appropriately
Step:	Apply the required heat to component pin and copper track
Step:	Clean soldering iron tip
Step:	Apply the correct amount of solder
Step:	Free board from oxidization

(2)

c. Outline the functions of the following tools when used for circuit construction.

De-soldering pump	Long nose plier

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ (4)

Question 7 **C-2 (12 marks)**

a. Find the total resistance of the circuit shown in Figure 3. Show all your workings.

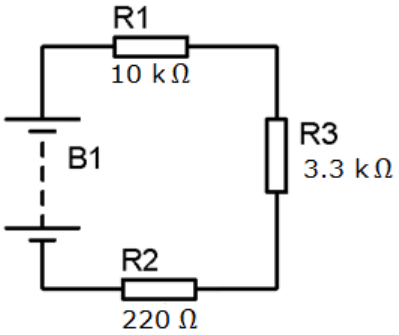


Figure 3 – Circuit 1

_____

_____

_____

_____

_____

_____ (4)

b. Find the total resistance of the circuit shown in Figure 4. Show all your workings.

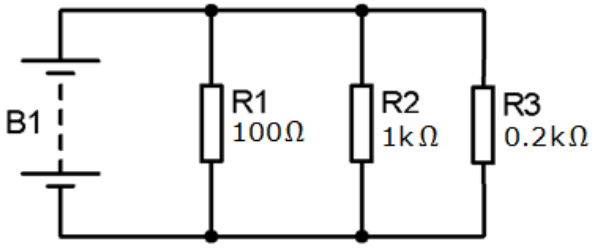


Figure 4 – Circuit 2

_____

_____

_____

_____

_____

_____ (4)

This question continues on next page.

c. Find the total resistance of circuit shown in Figure 5. Show all your workings.

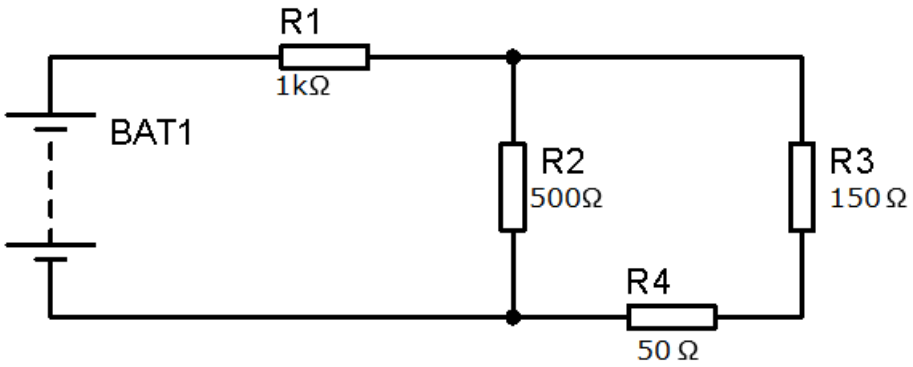


Figure 5 – Circuit 3

(4)

Question 8 **C-4 (12 marks)**

a. 'AND' and 'NOR' are types of logic gates. List **FOUR** other different logic gates and their respective symbols by completing Table 7.

Table 7 – Logic gates and their symbols.

	Logic Gate Name	**Logic Gate Symbol**
i.	_____	(1)
ii.	_____	(1)
iii.	_____	(1)
iv.	_____	(1)

b. Write the truth table of the following logic gates given in Table 8.

Table 8 – Logic gates and their truth tables.

Logic Gate	**Logic Gate Truth Table**
AND Gate	**Inputs** / **Output**: **A** | **B** | **Y**: 0 | 0 |; 0 | 1 |; 1 | 0 |; 1 | 1 | (2)

This question continues on next page.

NOR Gate

Inputs		Output
A	**B**	**Y**
0	0	
0	1	
1	0	
1	1	

(2)

c. Figure 6 shows the same circuit but with different logic inputs. Determine the output of the circuit shown below by filling in the boxes after each logic gate.

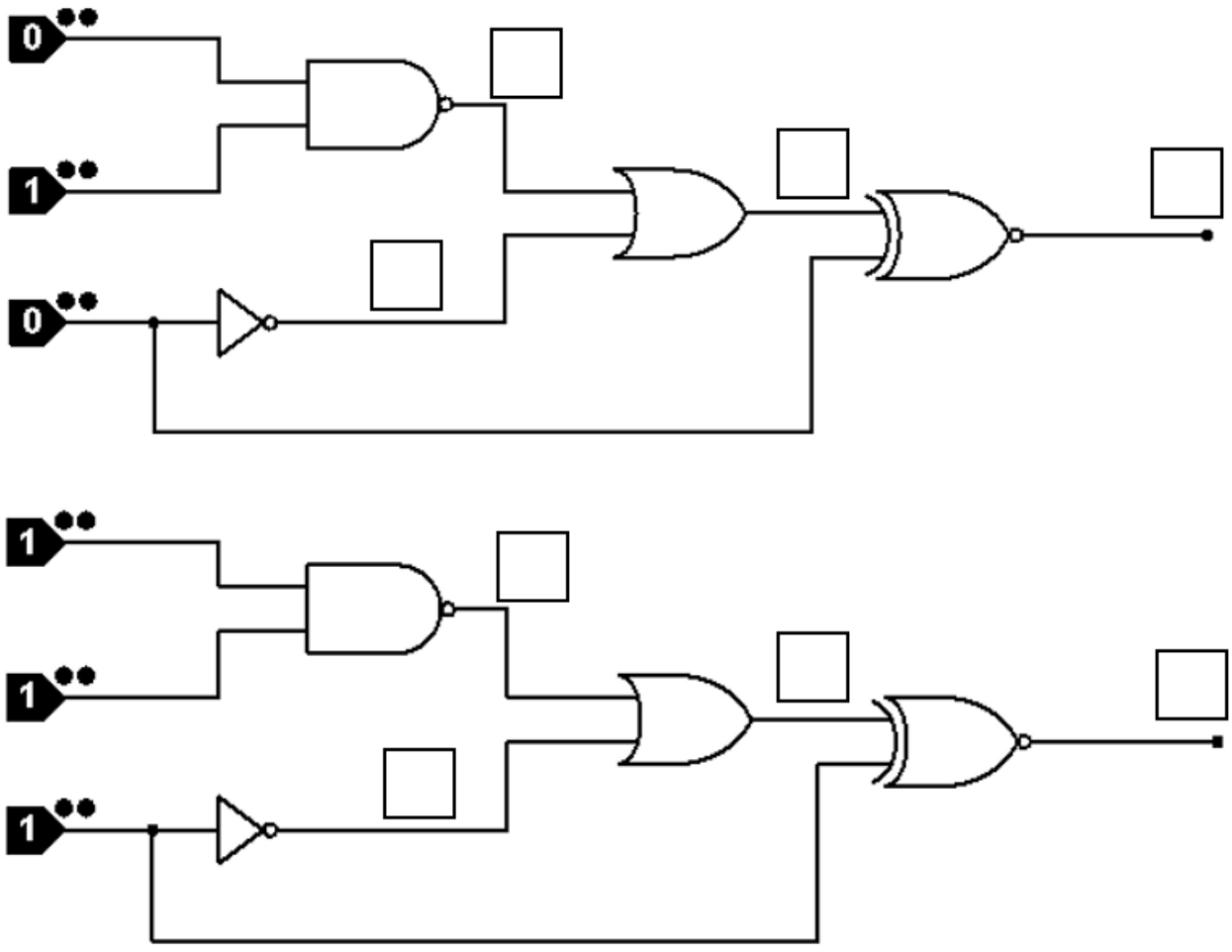


Figure 6 – Logic Circuit

(4)