higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRONIC AND DIGITAL CONCEPTS FOR ROBOTICS

NQF LEVEL 2

(First paper)

(10041042)

12 November 2024 (Y-paper)
13:00–16:00

This question paper consists of 9 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
ELECTRONICS AND DIGITAL CONCEPTS FOR ROBOTICS
NQF LEVEL 2
(FIRST PAPER)
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Use only a black or blue pen.
5. Write neatly and legibly.

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SECTION A

QUESTION 1

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 A/An … limits the flow of current.

A transistor
B relay
C inductor
D transformer

1.2 A/An … stores magnetic energy in a magnetic field that is generated by current in the coil.

A transistor
B relay
C inductor
D transformer

1.3 The negative terminal of a battery must be connected to the P-type material of the battery and the positive terminal to the N-type material:

A Forward bias
B Reverse bias
C PN-junction
D Rectifier

1.4 An advantage of an integrated circuit:

A Smaller circuit
B Easier to replace
C More reliable
D All of the above

1.5 The voltage supplied by a battery when there is no current flowing through an externally connected circuit:

A EMF
B Internal resistance
C Potential difference
D All of the above

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1.6 The amount of force applied perpendicular to the surface of an object per unit area:

A Pressure
B Density
C Force
D Resistance

1.7 The current flow in a closed circuit is directly proportional to the applied voltage in the circuit and inversely proportional to the resistance.

A Ohm's law
B Joule's law
C Power
D Energy



1.8 A nucleus in which protons and neutrons are present:

A Atom structure
B Atomic mass
C Ionic bond
D Covalent bond

1.9 Which diode can act as a voltage regulator by providing a constant voltage?

A LED
B PN-diode
C Zener diode
D Transducer



1.10 Which tool is used to cut thin wire and strip the plastic sleeving from copper?

A Long-nose plier
B Wire cutter
C Wire stripper
D Plier

(10 × 1) **[10]**

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QUESTION 2

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.10) in the ANSWER BOOK.

2.1 Two opposing types of material are used in a bipolar semiconductor.

2.2 Scientific notation refers to when numbers are written in groups of three.

2.3 Thermodynamics is the expression of the hotness or coldness of an object.

2.4 A solid angle is the space between two straight lines intersecting at a point.

2.5 A soldering iron is the piece of equipment used to join components, wires and conductors.

2.6 Acceleration can be calculated using velocity and time.

2.7 Conductors make it difficult for electric current to flow because they have few free electrons.

2.8 The charge in a direct-current circuit changes direction or reverses at regular intervals.

2.9 Passive infrared sensors measure the ambient temperature of their environment.

2.10 Kirchhoff's voltage law states that all voltages in series will add up to the total voltage.

(10 × 1) **[10]**

QUESTION 3

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–M) next to the question number (3.1–3.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1	Type of transducer used in medical equipment	A	OHSA
3.2	Desoldering pump	B	watter
3.3	Logic gate with two or more inputs	C	saturation
3.4	To protect the health and safety of all employees and employers	D	extrinsic semiconductor
3.5	Measuring the average of the power consumed by a circuit	E	push button
3.6	Used to cut insulation and other plastic materials	F	CMOS
3.7	Two-terminal resistor with variable resistance	G	photodiode
3.8	Impure semiconductor	H	metallic bonding
3.9	Fully switched transistor	I	solder sucker
3.10	Electrons shared with all atoms in a material	J	cable knife
		K	NOT
		L	AND
		M	rheostat

(10 × 1) **[10]**

TOTAL SECTION A: 30

SECTION B

QUESTION 4

4.1 Convert $4,678 \times 10^6$ to decimal notation. (1)

4.2 Convert 6 700 mega to giga. (1)

4.3 Convert 0,15 milli to micro. (1)

4.4 Calculate the distance a vehicle will travel in 20 min at a speed of 60 km/h. (5)

4.5 Determine the angle enclosed by an arc length of 8 cm in a circle with a radius of 2 cm. (5)

4.6 Draw a diagram of an atom with two shells. The inner shell has two electrons and the outer shell four. (3)

4.7 An electric toaster is plugged into a 220 V supply and it draws a current of 3,5 A.

Calculate the resistance of the heating element. (2)

4.8 A fan with a power rating of 20 W is used for one hour.

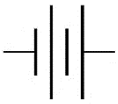
Calculate the total energy transferred. (2)

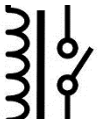
[20]

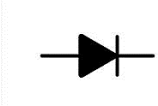
QUESTION 5

5.1 Identify each of the following component symbols:

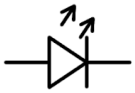
5.1.1 

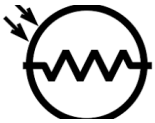
5.1.2 

5.1.3 

5.1.4 

5.1.5 

5.1.6 

5.1.7 

(7 × 1) (7)

5.2 Draw a full-wave rectifier circuit using two diodes. (8)
[15]

QUESTION 6

6.1 Define each of the following concepts:

6.1.1 Ohmmeter

6.1.2 Ammeter

6.1.3 Voltmeter

6.1.4 Wattmeter

6.1.5 Logic gate

(5 × 1) (5)

6.2 List FIVE safety precautions to keep in mind when working with electrostatic discharge. (5)
[10]

QUESTION 7

7.1 Give SIX advantages of a digital system. (6)

7.2 Briefly explain *De Morgan's theorem*. (2)

7.3 Draw each of the following:

7.3.1 OR gate circuit diagram

7.3.2 NOT gate IEC symbol

(2 × 2) (4)

7.4 Draw a circuit diagram of the distributive law for Boolean logic:

Q = (A + B) + C (2)
[14]

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QUESTION 8

8.1 Distinguish between *unsafe acts* and *unsafe conditions*. (2 + 2) (4)

8.2 List SEVEN general colour codes. (7)
[11]

TOTAL SECTION B: 70
GRAND TOTAL: 100

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