higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTROTECHNOLOGY
NQF LEVEL 2

XX February 2020

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 The current flowing in a circuit is proportional to the voltage✓ and inversely proportional to the resistance✓ provided that the temperature remains constant.✓ (3)

1.2 1.2.1 C
1.2.2 D
1.2.3 B
1.2.4 E
1.2.5 A

(5 × 1) (5)

1.3 $Q = I^2Rt$✓

$$t = \frac{Q}{RI^2}$$✓

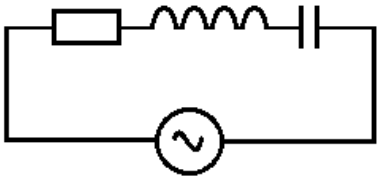
$$t = \frac{225\ 000}{44 \times 52}$$

$t = 204,6$ s✓

$$t = \frac{204,6}{60}$$

$= 3,4$ min✓ (4)

1.4 1.4.1



(2)

1.4.2 $X_L = 2\pi FL$
$X_L = 2\pi 50 \times 50 \times 10^{-3}$✓
$X_L = 157,0796\ \Omega$✓ (No units = no marks) (2)

1.4.3 $$X_C = \frac{1}{2\pi FC}$$
$$X_C = \frac{1}{2\pi 50 \times 150 \times 10^{-6}}$$✓

$X_C = 21,221\ \Omega$✓ (No units = no marks) (2)

1.4.4 $$Z = \sqrt{R^2 + (X_C - X_L)^2}$$

$$Z = \sqrt{22^2 + (22,221 - 157,0796)^2}$$✓

$Z = 136,641\ \Omega$✓ (No units = no marks) (2)

[20]

QUESTION 2

2.1 2.1.1 Battery
2.1.2 Fuse
2.1.3 Relay
2.1.4 Circuit breaker
2.1.5 Lamp/Light

(5 × 1) (5)

2.2 With the battery connected✓ the relay will energise,✓ closing the ON contact of the relay.✓ If the circuit breaker is closed✓ the lamp will go ON. (4)

2.3 2.3.1
- Switch
- Push button (Any ONE) (1)

2.3.2 Between the fuse and the relay coil (1)

2.4 Earthing is the process by which all electrical circuits and metal parts✓ of an installation are bonded to the earth.✓ (2)

2.5 2.5.1 $P = V \times I$

$$I = \frac{P}{V}\checkmark$$

$$I = \frac{3\,000}{220}\checkmark$$

$I = 13{,}63\ A\checkmark$ (15 – 20 A circuit breaker) (3)

2.5.2
- Size and type of load to be supplied
- Permissible voltage drop
- Prospective fault current
- Circuit protection
- Installation conditions such as:
  - Excessive high temperature
  - Close to corrosive substances (Any 4 × 1) (4)

2.6 Under normal circumstances the current through the live and neutral conductors will be equal in magnitude but in opposite directions.✓ The load-carrying conductors at any given moment will be zero, which results in no EMF being induced in the secondary windings.✓ If, however, there is a fault, then an earth-leakage current exists.✓ In this case, the live and neutral conductors do not balance as one conductor carries more current than the other.✓ In this situation the earth-leakage device produces a change of magnetic flux in the sensing core.✓ The EMF induced in the secondary winding activates the trigger circuit.✓ The tripping coil is energised and the circuit breaker opens to switch the power off or, in other words, trip circuit.✓

(Any 5 × 1) (5)

[25]

QUESTION 3

3.1
3.1.1 Brown, black, red, silver
3.1.2 Grey, red, red, gold
3.1.3 Brown, black, yellow
3.1.4 Blue, grey, green, gold
3.1.5 910 kΩ, 5%
3.1.6 270 kΩ, 10%

(6 × 1) (6)

3.2
3.2.1 A step-down transformer with a mains 240 V AC input was stepped down to 18 V RMS which is a suitably low voltage for the circuit.

3.2.2 A rectifier is able to direct (rectify) the current through the negative and positive cycles to flow in one direction only, in other words converting from AC to pulsating DC. This could also be shown through drawing and annotating a waveform diagram.

3.2.3 The charge and discharge of the capacitor during the pulsating cycle produces a smoothed DC output. This could also be shown through drawing and annotating a waveform diagram.

3.2.4 The voltage regulator set the voltage at 12 V and allowed the voltage to remain constant at the output despite varying current demand.

(4 × 2) (8)

3.3
- Soldering iron
- Solder sucker
- Side cutters
- Long nose pliers

(Any 3 × 1) (3)

3.4

ITEM NR	DESCRIPTION	QUANTITY
1	CRO input sockets	2
2	Battery/Power supply	1✓
3	LED	2✓
4	Transistor	2✓
5	Resistors	4✓
6	Variable resistors	2✓
7	Capacitors	2✓
8	Diode	1✓

✓

(8)
[25]

QUESTION 4

4.1
- Preventive maintenance procedures: These are activities performed routinely to extend the life or increase the performance of equipment. It usually include procedures associated with scheduled servicing and inspection of electrical equipment and systems for equipment to last longer with fewer breakdowns and repairs at the wrong time.
- Corrective maintenance procedures: These are activities done because of partial or total equipment failure. An example is the replacement of a burnt relay coil or transformer.
- Predictive maintenance procedures: These activities are used to predict the performance of an equipment item, for example by monitoring a particular type of equipment over a long period of time, the performance and life expectancy of a similar item can be estimated. (3 × 2) (6)

4.2 4.2.1 Points A and B (1)

4.2.2 24 V (1)

4.2.3 0 V because the auxiliary contact of K1 is open (2)

4.2.4
- Stop button stuck in open position
- Start button faulty
- Relay K1 faulty and not energising
- Auxiliary contact K1 in line with relay K2 not closing
- Wire between auxiliary contact and relay coil broken
- 0 V wire to the K2 relay coil broken
- Coil of K2 relay open circuit (Any 4 × 1) (4)

4.3
- Use a multimeter on the ohm scale selection.
- Take a reading across the coil of the relay.
- You should get a resistance reading of the coil. (3)

4.4 4.4.1 continuity

4.4.2 not make good

4.4.3
- electrocution
- electric shock
- burns and falls (Any ONE) (3 × 1) (3)

[20]

QUESTION 5

5.1 Fault reports assist in the determination of:
- The life span of components/tools/machinery
- The quality of components/tools/machinery
- The poor design of components/tools/machinery
- The components/tools/machinery rating (4)

5.2 5.2.1 Conveyor (1)

5.2.2
- Conveyor: ±97 min
- Hoist: 55 min
- Oven: ±68 min (3)

5.2.3 Shortening the frequency of the preventive maintenance at six months (the time was high) (2)

[10]

TOTAL: 100

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