



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE ELECTRICAL TRADE THEORY N1

1 AUGUST 2017

This marking guideline consists of 6 pages.

QUESTION 1

- 1.1
- Floor must be skid-free.
 - Roofs must not leak.
 - Walkways must be clean and obstacle-free.
 - There must be enough lighting.
 - Guards must be installed on stairways and dangerous places. (Any 4 × 1) (4)
- 1.2 The most important thing always to be aware of is safety – your own as well as that of others. (2)
- 1.3 Leather gloves are worn while grinding or working with hot or sharp objects. (2)
- 1.4 Connect a light bulb between live and neutral. The light will turn on if a conductor or terminal is live. A digital multimeter may be used. Connect the red probe to live and the black probe to neutral. If voltage is present, the meter will show a value. (Any 2 × 1) (2)
- 1.5
- Switch off the mains supply to the load.
 - Switch off the isolator and lock it in the off position. Keep the key with you.
 - Fuses may be removed and taken with as an extra precaution.
 - Display a notice at the point of isolation. (Do not switch on, men working on line.) (4)
- [14]**

QUESTION 2

- 2.1 The current flowing in an electrical circuit is proportional to the applied voltage and inversely proportional to the resistance of the circuit. (i.e. temperature constant) (3)
- 2.2
- 2.2.1 $V_T = I_T \times R_T$ $R_T = 4 + 8$
 $= 2 \times 12 \checkmark$ $= 12 \Omega \checkmark$
 $= 24 V \checkmark$ (3)
- 2.2.2 $V_{R8} = I_T \times R_8$
 $= 2 \times 8 \checkmark$
 $= 16 V \checkmark$ (2)
- 2.3
- The type of material from which the conductor is made
 - The length of the conductor in metres
 - The length of the conductor
 - The cross-sectional area of the conductor in m²
 - The cross-sectional area of the conductor
 - The temperature of the conductor (Any 4 × 1) (4)

2.4
$$R = \frac{\rho \times \ell}{a}$$

$$= (0,0172 \times 10^{-6} \times 500) \div 28,27 \times 10^{-6} \checkmark \checkmark$$

$$= 0,304 \Omega \checkmark \checkmark$$
(4)
[16]

QUESTION 3

3.1 Flux density is the number of lines of force per unit area. (2)

- 3.2
- Place an iron core on the inside of the coil.
 - Increase the current flow.
 - Place more turns on the coil.
 - Shorten the magnetic circuit (decreasing the length of the core).
 - Increase the volume of the core but not its length. (Any 4 × 1) (4)

3.3 3.3.1 $(V_1 \div V_2) = (N_1 \div N_2)$

$$N_2 = N_1(V_2 \div V_1) \checkmark$$

$$= 1000(80 \div 280) \checkmark$$

$$= 286 \text{ turns } \checkmark$$

$$\frac{N_1}{N_2} = \frac{V_1}{V_2}$$
Therefore
$$N_2 = \frac{N_1 \cdot V_2}{V_1} \checkmark$$

$$N_2 = \frac{600 \times 16,13}{220} \checkmark$$

$$= 43,99 \text{ turns}$$

$$= 44 \text{ turns } \checkmark$$

3.3.2 $(V_1 \div V_2) = (I_2 \div I_1)$

$$I_1 = I_2(V_2 \div V_1) \checkmark$$

$$= 40(80 \div 280) \checkmark$$

$$= 11,43 \text{ A } \checkmark$$
Therefore
$$\frac{V_1}{V_2} = \frac{I_2}{I_1}$$

$$I_1 = \frac{V_2 \cdot I_2}{V_1} \checkmark$$

$$= \frac{16,13 \times 5}{220} \checkmark$$

$$= 0,366 \text{ A/amps/amperes } \checkmark$$

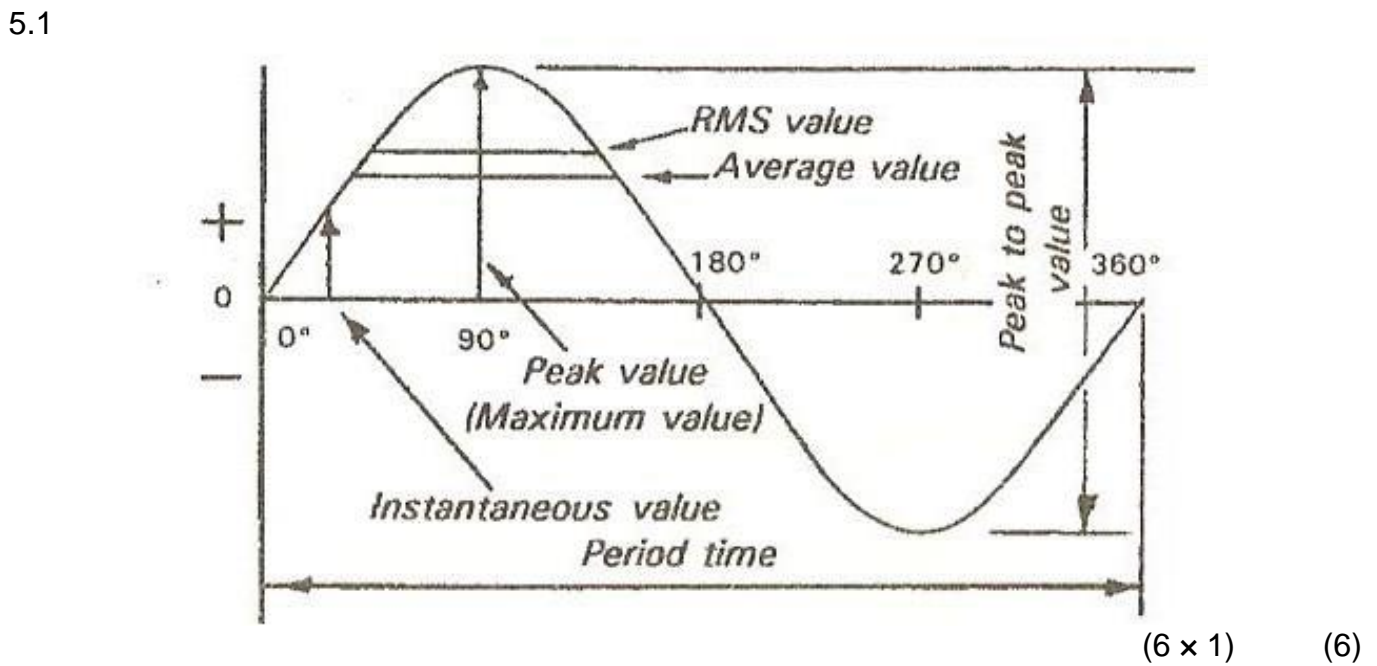
(2 × 3) (6)
[12]

QUESTION 4

- 4.1
- Primary cells cannot be recharged but secondary cells can be re-charged repeatedly.
 - Primary cells are cheap, but secondary cells are more expensive.
 - Primary cells provide smaller currents, while secondary cells provide larger currents.
- (Any 1 × 2) (2)
- 4.2 The Leclanche cell (1)
- 4.3
- Chemical reaction: cells and batteries
 - Electromagnetic induction: AC and DC generators
 - Solar energy: solar cells
 - Heat: thermocouple pyrometer
 - Hydro-electric: using turbines and a dam
- (Any 3 × 2) (6)

[9]

QUESTION 5



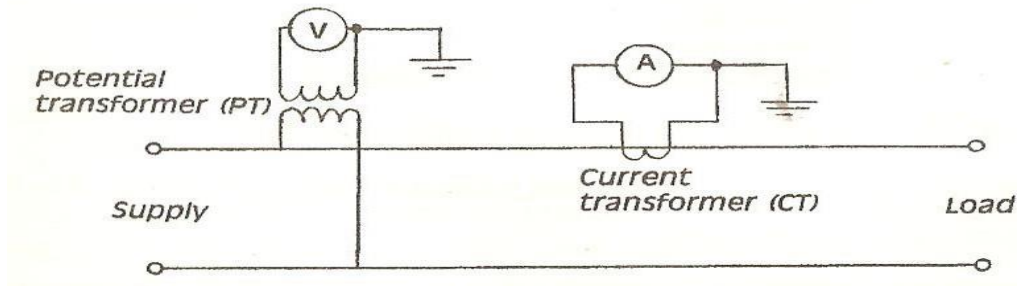
- 5.2 The magnitude of the induced EMF is proportional to the rate of change of flux linking with the circuit. (3)

[9]

QUESTION 6

- 6.1
- Air damping
 - Eddy current (magnetic) damping
- (2)

6.2



- Supply
 - Load
 - Current transformer
 - Potential transformer
 - Voltmeter
 - Ammeter
 - Correctness for both diagrams
- (8)
[10]

QUESTION 7

- 7.1
- They are combustible but self-extinguishing.
 - They are non-toxic.
 - They are ozone-friendly.
 - They are weather-resistant.
 - They are non-corrosive.
 - They have a high impact strength.
 - Synthetic thermoplastic resins are good insulators.
- (Any 4 × 1) (4)
- 7.2 Because the sulphur in the rubber reacts with the copper (2)
- 7.3 Being so connected to the general mass of the earth as to ensure, at all times, an immediate discharge of electrical energy without danger directly to earth. (4)
- 7.4 Miniature circuit breaker (1)
- 7.5
- They look untidy.
 - They are exposed to vandalism.
 - Birds often nest on pylons which can cause faults.
 - They are exposed to growing and falling trees.
 - They are exposed to the weather and especially to lightning.
 - They constitute a safety hazard to people, animals and property.
- (Any 4 × 1) (4)
[15]

QUESTION 8

8.1 The earth leakage protection test (1)

8.2 An AC (RMS value) or DC voltage of at least twice the normal voltage, with a minimum of 500 V, must be used when doing insulation resistance testing. (3)

8.3

- Torches
- Toys
- Motor vehicles

(Any 1 x 1) (1)

8.4 Blue = 6; Red = 2; Yellow = 4; Gold = 5%
R = 620 000 Ω ± 5% OR R = 620 KΩ ± 5% (5)

8.5

$$(1 \div C_T) = (1 \div C_1) + (1 \div C_2) + (1 \div C_3) \checkmark$$

$$= (1 \div 9) + (1 \div 7) + (1 \div 18) \checkmark$$

$$= 0,309 \checkmark$$

$$C_T = (1 \div 0,309) \checkmark$$

$$C_T = 3,236 \mu F \checkmark$$

-

$$\frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \checkmark$$

$$\frac{1}{C_t} = \frac{1}{9} + \frac{1}{7} + \frac{1}{18} \checkmark$$

$$= \frac{126 + 163,4 + 63}{1134} \checkmark$$

$$\frac{1}{C_t} = \frac{352}{1134} \checkmark$$

Therefore $C_t = \frac{1134}{352} \checkmark$

$$= 3,221 \mu F \checkmark$$

(5)
[15]

TOTAL: 100