higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ELECTRICAL TRADE THEORY N1

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This marking guideline consists of 5 pages.

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QUESTION 1

1.1
- Joints in flexible cords
- Cracked or broken insulation
- Loose connections
- Switches in bad order (4)

1.2
- Danger
- Emergency stop controls
- Fire protection equipment
- Stop buttons✓ (4)

1.3 1.3.1 B
1.3.2 C
1.3.3 A
(3 × 2) (6)
[14]

QUESTION 2

2.1 Joule's law states that the heat generated in an electric circuit is proportional to:✓ the square of the current (I^2),✓✓ the resistance of the circuit (R),✓ the time during which the current flows (t).✓ (5)

2.2 2.2.1
$R_T = R_1 + R_2 + R_3$
$= 20 + 30 + 40$✓
$\underline{= 90\ \Omega}$✓ (2)

2.2.2
$I_T = V_T \div R_T$
$I_T = 60 \div 90$✓
$I_T \underline{= 0{,}667}$ A✓ (2)

2.2.3

$V_{R1} = I_T \times R_1$	$V_{R2} = I_T \times R_2$	$V_{R3} = I_T \times R_3$
$V_{R1} = 0{,}667 \times 20$✓	$V_{R2} = 0{,}667 \times 30$✓	$V_{R3} = 0{,}667 \times 40$✓
$V_{R1} \underline{= 13{,}34\ V}$✓	$V_{R2} \underline{= 20{,}01\ V}$✓	$V_{R3} \underline{= 26{,}68\ V}$✓

(6)

2.2.4

$P = V \times I$	$P = I^2 \times R$	$P = V^2/R$
$P = 60 \times 0{,}667$✓ OR	$P = (0{,}667)^2 \times 90$✓ OR	$P = 60^2 \div 90$✓
$P \underline{= 40{,}02\ W}$✓	$P \underline{= 40{,}04\ W}$✓	$P \underline{= 40\ W}$✓

(2)

2.3 Heat will increase.✓ (1)
[18]

QUESTION 3

3.1
- Increase in the current flowing through the circuit.
- Increase in the number of turns of the solenoid. (2)

3.2
- Open-air cooling
- Oil cooling (2)

3.3 3.3.1 Turns ratio = $N_1 : N_2$
Turns ratio = 200 : 50✓
Turns ratio = 4 : 1✓

3.3.2 $(V_1 \div V_2) = (N_1 \div N_2)$
$V_2 = (N_2 \div N_1) \times V_1$
$V_2 = (50 \div 200) \times 220$✓
$V_2 = 55$ V✓

3.3.3 $I_2 \div I_1) = (N_1 \div N_2)$
$I_2 = (N_1 \div N_2) \times I_1$
$I_2 = (200 \div 50) \times 10$✓
$I_2 = 40$ A✓

3.3.4 $S_1 = V_1 I_1$
$= 220 \times 10$✓
$= 2,2$ KVA✓

OR

$S_2 = V_2 I_2$
$= 55 \times 40$✓
$= 2,2$ KVA✓

(4 × 2) (8)

3.4
- Primary circuit
- Secondary circuit
- Magnetic circuit (3)

[15]

QUESTION 4

4.1
- Carbon brushes
- Slip-rings (2)

4.2 The rms (root mean square) value is the effective value of the current or voltage or that value of current which is equivalent to direct current when compared on an energy basis.✓✓✓ rms = 0,707 × the maximum value.✓ (4)

4.3 1,230 to 1,280✓✓ (2)

4.4 The commutator acts as a mechanical rectifier.✓ It converts the AC produced to a DC output.✓ (2)

[10]

QUESTION 5

5.1
- Pointer
- Damping system
- Controlling system
- Fixed field system (4)

5.2 Damping is to prevent the pointer from oscillating before settling at a point on the scale.✓✓ Air damping and eddy current.✓✓ (4)

5.3 When measuring high ac voltages and currents. (2)
[10]

QUESTION 6

6.1
- Mica
- Oil impregnated paper
- Porcelain and glass
- Vulcanised rubber insulation (VRI)
- Polyvinyl chloride (PVC)✓ (5)

6.2
- Relatively cheap
- Easy to colour
- Flexible
- Tough
- Has a low fire risk
- Can be extruded and injection moulded
- Can resist damage from oils, acids, alkalis etc.
- Largely unaffected by exposure to sunlight (Any 4 × 1) (4)

6.3 The insulation of each conductor must be able to withstand the highest conductor voltage in the wire way. (1 × 3) (3)
[12]

QUESTION 7

7.1 In order that the full supply is connected to each light. (2)

7.2 When something is so connected to general mass of the earth as to ensure all times✓✓ an immediate discharge of electrical energy without danger directly to earth.✓✓ (4)

7.3
- It is easy to locate and repair a fault.
- They can be erected in rocky areas. (2)
[8]

QUESTION 8

8.1 Insulation resistance tester (Megger). (1)

8.2 The earth leakage protection test. (1 × 2) (2)

8.3 It will mean that the outer thread✓ of Edison-screw lamp holder would be connected to the live conductor,✓✓ creating a potential electrical hazard.✓ (4)

8.4
- Germanium
- Silicon (2)

8.5 $C_T = C_1 + C_2 + C_3$✓
$= 9 + 12 + 10$✓
$= 31\ \mu F$✓✓ (4)
[13]

TOTAL: 100

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