higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

ELECTRICAL TRADE THEORY N3

23 NOVEMBER 2016

This marking guideline consists of 7 pages.

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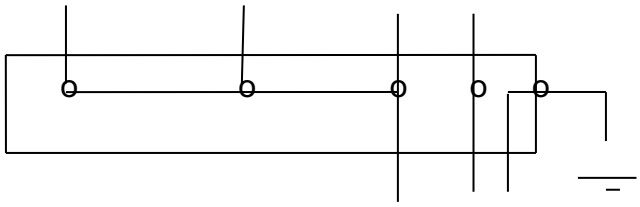
NOTE: There is not only one answer or one method (approach) of answering the questions. This marking guideline gives only one answer or one possible method (approach). Examiners must analyse the student's solution to determine if the question has been answered and therefore must not adhere strictly to this marking guideline.

QUESTION 1: DOMESTIC APPLIANCES

1.1
- Use energy saving lamps.
- Switch off geyser while away.
- Boil only enough water for hot drinks. (Any 3 suitable answers) (3 x 1) (3)

1.2 stove wiring from connection box



L ✓ N E✓
supply conductors (3)

1.3
- Check plug and cord for damages.
- Check if on-off switch is in order.
- Check if motor is not too dusty. (Any 3 suitable answers) (3)

1.4 Switch the geyser isolator off. (1)
[10]

QUESTION 2: PROTECTION

2.1
- Ensure that no-one can insert their fingers into power sockets.
- Ensure that children cannot pull electrical appliances from table tops.
- Check that the insulation of electrical cords are in a good condition. (3 x 1) (3)

2.2 2.2.1 In the distribution board
2.2.2 Between the earth electrode and the earth bar
2.2.3 In the ground
(3 x 1) (3)

2.3 2.3.1 When the current exceeds the design value,✓ the bimetal strip bends far enough to activate the trigger mechanism that operates the trip switch.✓ (2)

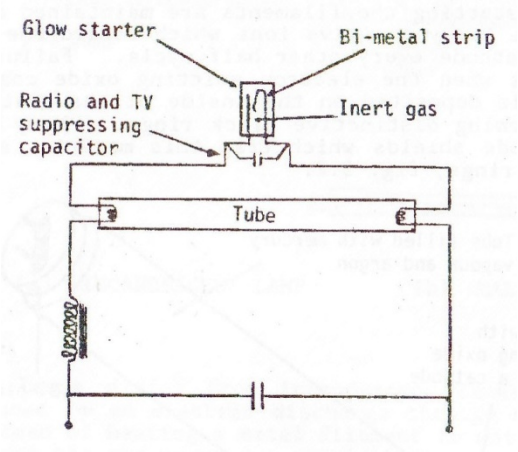
2.3.2 A coil causes a magnetic field close to the iron armature✓ which is immediately attracted and activates the trigger mechanism that operates the trip switch.✓ (2)
[10]

QUESTION 3: ILLUMINATION

3.1 3.1.1 The lamp cathodes
3.1.2 To limit current
3.1.3 To improve the circuit's power factor

(3 x 1) (3)

3.2



glow starter✓

suppressor✓

tube correctly coupled✓

surge coil✓

(4)

3.3 The two lamp circuits must be connected to the supply (in parallel).✓
The one lamp circuit must have a capacitor✓ connected in series✓ with the lamp. (3)
[10]

QUESTION 4: ALTERNATING CURRENT THEORY

4.1 RMS = $0,707.E_m$✓
= 0,707.381✓
= 269.37 V✓ (3)

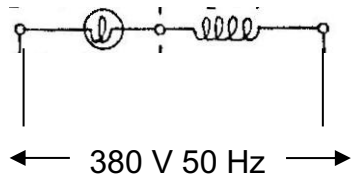
4.2 $2.\pi.f = 628,32$✓
$f=628,32/2\pi$✓
f = 100 Hz✓ (3)

4.3 e = 381sin(628,32t) ✓
= 381 x sin(628,32 x 0,005)
= 381 x 7 x 10^{-6}✓
= 0 V✓ (3)

4.4 Instantaneous value is the value of the voltage waveform at any given point in time after the wave has commenced. It means the specific value of the wave at a specific moment in time. (1)
[10]

QUESTION 5: SERIES RLC CIRCUITS

5.1 220 V
100 W L



Lamp in series with L ✓
220 V across lamp ✓
380 V supply✓

(3)

5.2 I = P/V ✓
= 100/220 ✓
= 0,455 A✓

(3)

5.3 R = V/I✓
=220/0,455 ✓
= 484 Ω✓
OR
$P = V^2/R$
$R = V^2/P$
$= 220^2/100$
= 484 Ω

(3)

5.4 The inductive reactance of the coil reduces the voltage across the lamp, thus allowing for the higher voltage to be connected across the lamp.

(1)
[10]

QUESTION 6: THREE-PHASE AC SYSTEMS

6.1 Three rotating coils 120°✓apart.

(1)

6.2 6.2.1 $P = \sqrt{3}.V_L I_L \cos\Phi$✓
$= \sqrt{3}$ x 380 x 50 x cos(30°)✓
= 28,5 kW✓

(3)

6.2.2 $S = \sqrt{3}.V_L I_L$✓
$= \sqrt{3}$ x 380 x 50✓
= 32,9 kVA✓

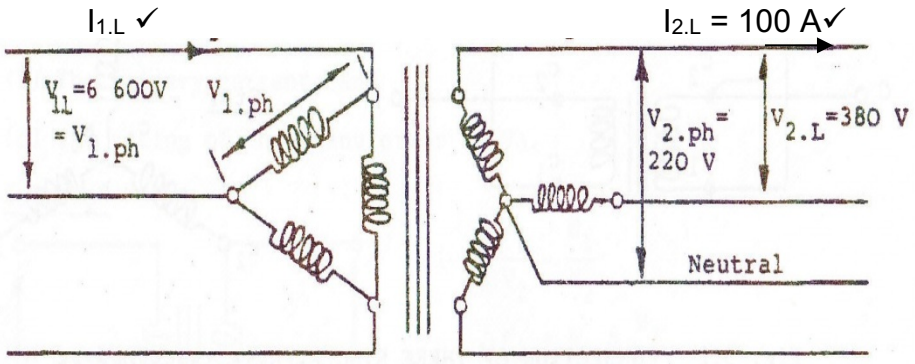
(3)

6.2.3 VAR = $\sqrt{3}$ x $V_L I_L \sin\Phi$ ✓
= $\sqrt{3}$ x 380 x 50 x sin(30°) ✓
= 16 454 VAR ✓

(3)
[10]

QUESTION 7: TRANSFORMERS

7.1



(phase voltages ✓✓ 6,6 kV line voltage ✓) (5)

7.2 $N_1 / N_2 = V_1 / V_2$✓
= 6 600/220 ✓
= 30:1✓ (3)

7.3 $S = \sqrt{3} .V_L.I_L$✓
= $\sqrt{3}$ .380.100✓
= 65 818 VA✓
= 66 kVA (3)
[10]

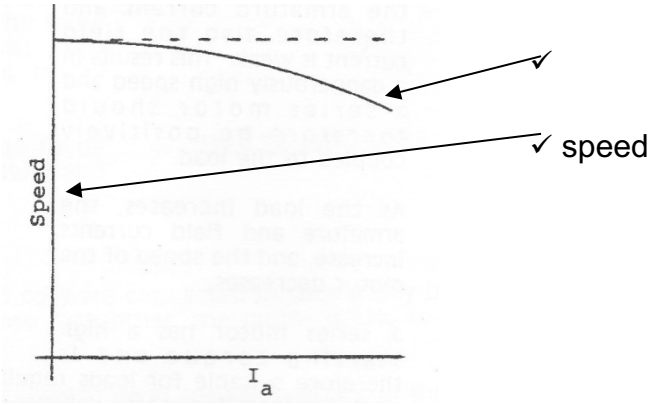
QUESTION 8: DIRECT-CURRENT MACHINES

8.1 8.1.1 It keeps the field coil in position✓ and provides a better path for the magnetic flux.✓ (Any 2 suitable answers)

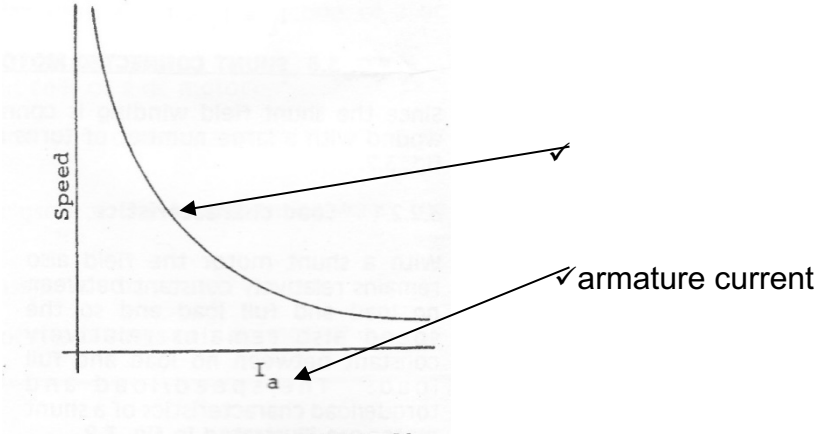
8.1.2 The field coil is placed over it✓ and provides a path for the magnetic flux.✓ (Any 2 suitable answers)

8.1.3 It completes the path for the magnetic flux and provides protection for the inside of the motor.✓ The end plates that house the bearings are bolted to it.✓ (Any 2 suitable answers)
(3 x 2) (6)

8.2 8.2.1 A shunt-connected motor



8.2.2 A series-connected motor



(2 x 2) (4)
[10]

QUESTION 9: ALTERNATING-CURRENT MACHINES

9.1 Split-phase induction motor, AC series motor, repulsion motor, shaded-pole synchronous motor (2)

9.2 Wound rotor and squirrel-cage rotor (2)

9.3 To disconnect the circuit ✓when the voltage falls below the design value of the no-volt coil✓ (2)

9.4 9.4.1 False
9.4.2 False
9.4.3 True
9.4.4 True

(4 x 1) (4)
[10]

QUESTION 10: MEASURING INSTRUMENTS AND ELECTRONICS

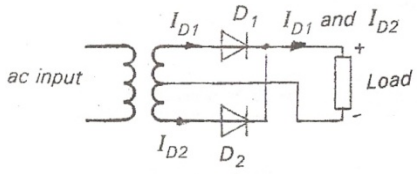
10.1 10.1.1 They provide a reverse (controlling) torque against the deflecting torque.

10.1.2 It increases the magnetic attraction force when a coil nearby carries current.

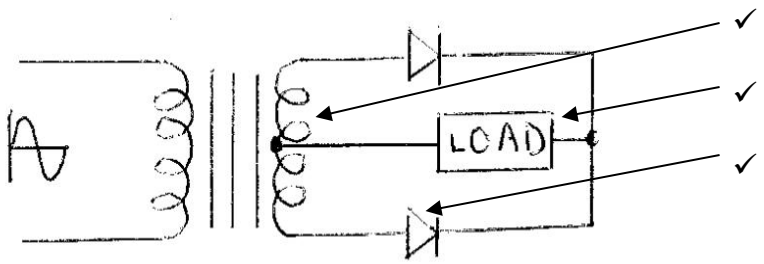
10.1.3 They provide a second magnetic field which will influence the moving coil field.

(3 x 1) (3)

10.2 10.2.1 A full-wave rectifier using two diodes and a centre-tap transformer

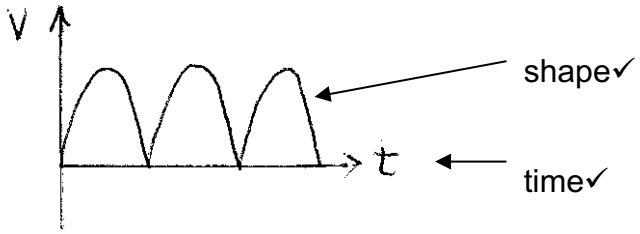


OR



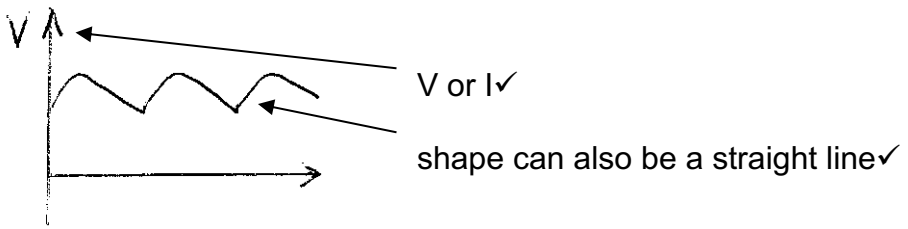
(3)

10.2.2



(2)

10.2.3



(2)
[10]

TOTAL: 100

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