



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE ELECTRICAL TRADE THEORY N3

31 JULY 2018

This marking guideline consists of 8 pages.

QUESTION 1

- 1.1 **Note:** A and H may be interchanged as it is not chronologically critical for the procedure
- D
B
E
G
C
H
A
I
F
- (9 × 1) (9)
- 1.2 Nichrome
- (1)
[10]

QUESTION 2

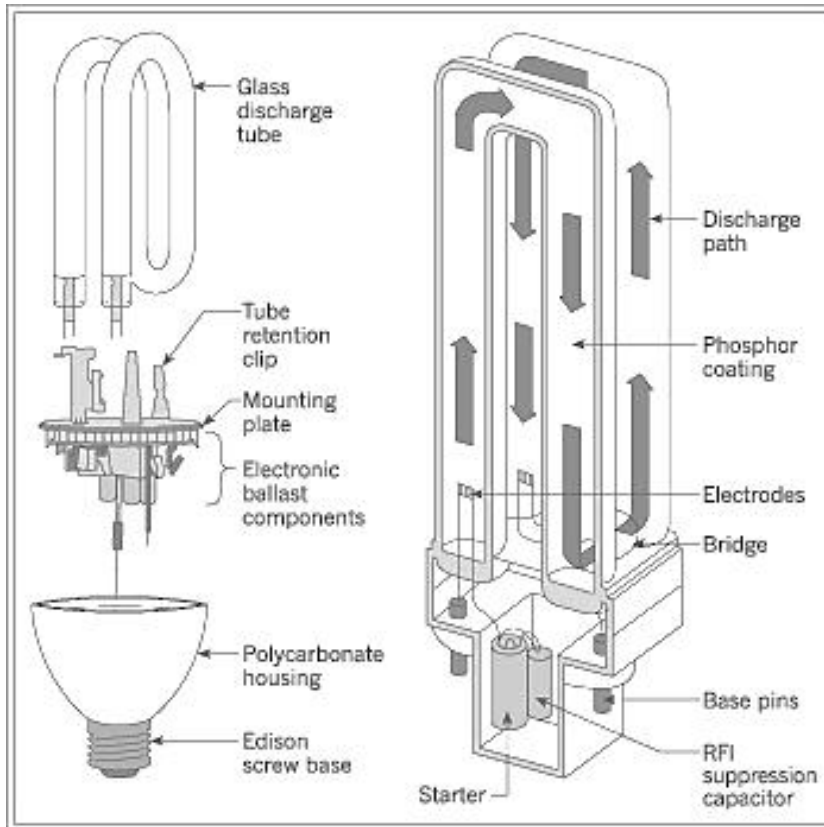
- 2.1 2.1.1 The Circuit breaker automatically disconnects a circuit to stop the flow of current when the rated tripping value of the breaker is exceeded.
- 2.1.2 The earth leakage detects an earth-leakage current and then isolates the electrical supply from the load.
- (2 × 2) (4)
- 2.2 2.2.1 Tripping relay
2.2.2 Tripping coil
2.2.3 Test circuit
2.2.4 Primaries
2.2.5 Secondary windings
2.2.6 Laminated iron core
- (6 × 1) (6)
[10]

QUESTION 3

- 3.1 3.1.1 D
3.1.2 E
3.1.3 B
3.1.4 A
3.1.5 C
- (5 × 1) (5)
- 3.2 A – Sodium-vapour discharge lamp
B – Halogen lamp
C – Incandescent Lamp
- (3)

- 3.3
- A gas-filled tube
 - A magnetic or electronic ballast
 - Filament / Electrode

Note:



Purpose of image is to assist marker in gaining a clearer understanding of the options a candidate may express in this question. The CFL is essentially a fluorescent tube and consist of basically similar components but in compact form.

(2)
[10]

QUESTION 4

4.1 250 A (1)

4.2 $I_{rms} = 0,707 I_{max}$
 $= 0,707 \times 250 \checkmark$
 $= 176,75 \text{ A } \checkmark$ (3)

4.3 $W = 2\pi f \checkmark$
 $= \frac{314}{2 \times 3,14} \checkmark$
 $= 50 \text{ Hz} \checkmark$ (3)

$$\begin{aligned}
 4.4 \quad i &= Im \sin 314 t \checkmark \\
 &= 200 \sin(314 \times 0,008 \times 57,3) \\
 &= 200 \times 0,588 \checkmark \\
 &= 117,733A \checkmark
 \end{aligned}$$

(3)
[10]

QUESTION 5

$$\begin{aligned}
 5.1 \quad Z &= \sqrt{R^2 + (X_C - X_L)^2} \checkmark \\
 &= \sqrt{5^2 + (15 - 10)^2} \checkmark \\
 &= \sqrt{25 + 25} \\
 &= \sqrt{50} \\
 &= 7,071 \text{ ohms} \checkmark
 \end{aligned}$$

(3)

$$\begin{aligned}
 5.2 \quad I &= \frac{V_T}{Z_1} \checkmark \\
 &= \frac{220}{7,07} \checkmark \\
 &= 31,112 A \checkmark
 \end{aligned}$$

(3)

$$\begin{aligned}
 5.3 \quad V_R &= IR \checkmark \\
 &= 31,112 \times 5 \checkmark \\
 &= 155,563 V \checkmark
 \end{aligned}$$

(3)

5.4 Current flow in a capacitor leads ✓ the applied voltage by 90 degrees. (1)
[10]

QUESTION 6

$$\begin{aligned}
 6.1 \quad 6.1.1 \quad I_L &= \sqrt{3} I_{ph} \checkmark \\
 I_{ph} &= \frac{12}{\sqrt{3}} \checkmark \\
 &= 6,928 A \checkmark
 \end{aligned}$$

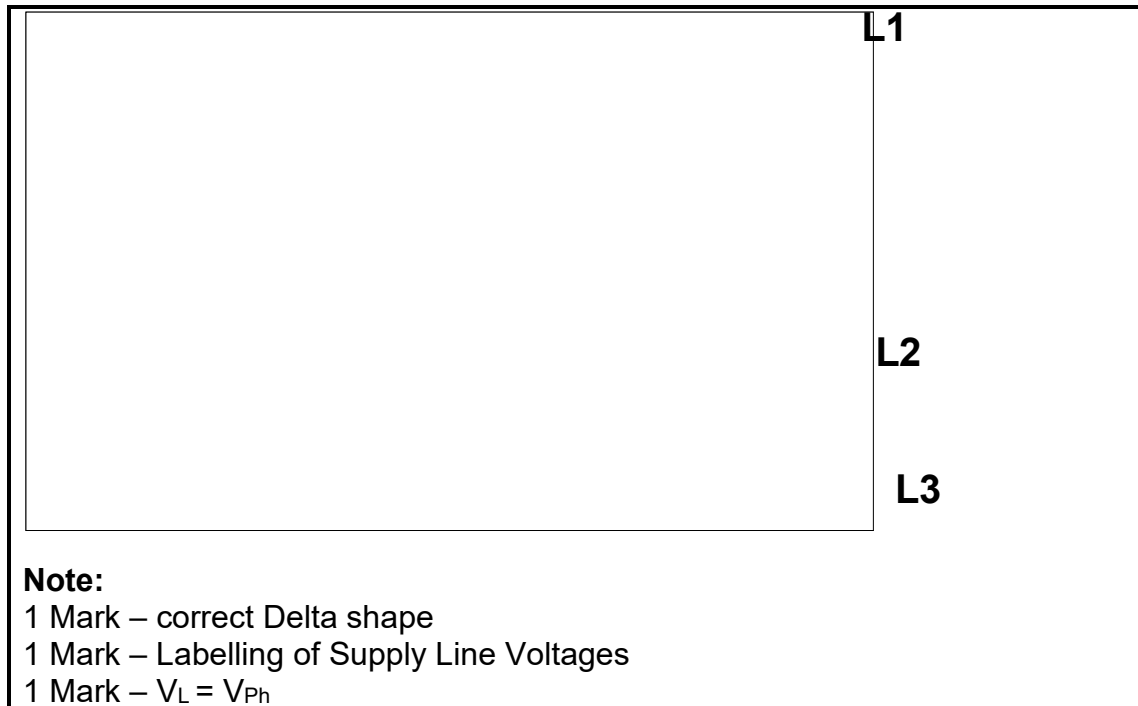
(3)

$$6.1.2 \quad V_L = V_{PL} = 415 V \checkmark \quad (1)$$

$$\begin{aligned}
 6.1.3 \quad P &= \sqrt{3} V_L I_L \cos \theta \checkmark \\
 &= \sqrt{3} \times 415 \times 12 \times 0,86 \checkmark \\
 &= 7418 W \\
 &= 7,418 kW \checkmark
 \end{aligned}$$

(3)

6.2

(3)
[10]**QUESTION 7**

7.1 Transformers operate on the principle of mutual ✓| inductance✓. (2)

7.2 7.2.1 Turns ratio = $\frac{v_{ph1}}{v_{ph2}}$ ✓
 $= \frac{22\ 000}{2\ 200}$ ✓
 $= 10 : 1$ ✓ (3)

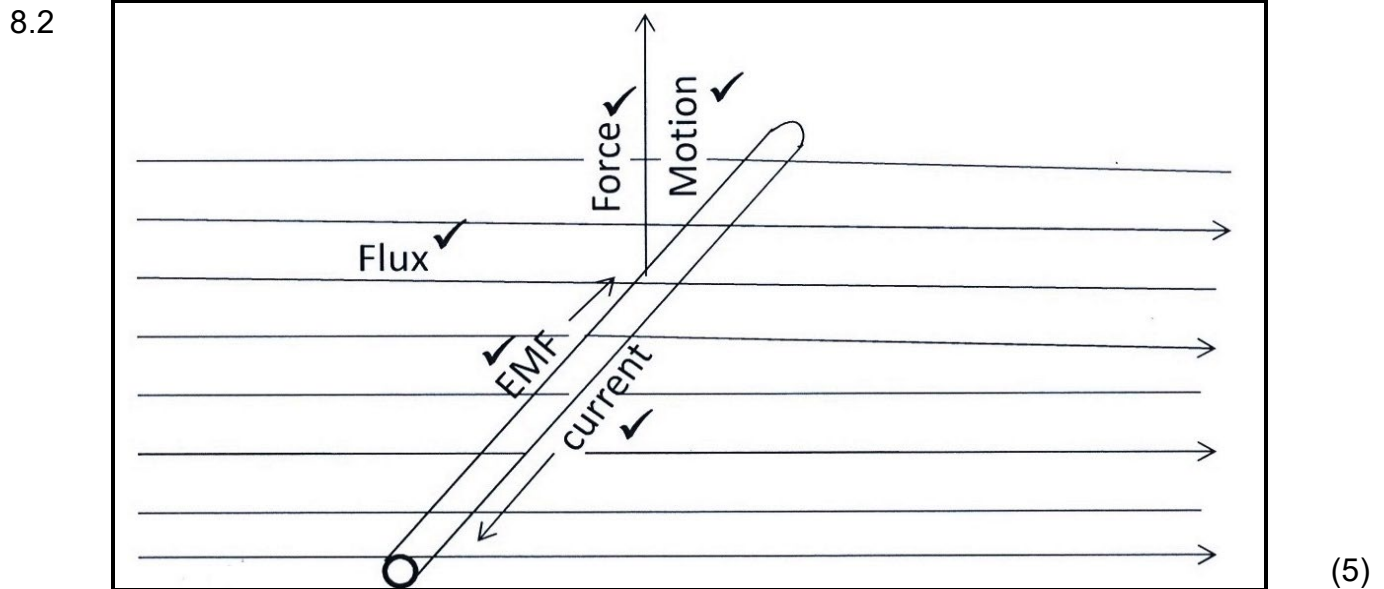
7.2.2 $I = \frac{S}{\sqrt{3}V_L \cos \theta}$ ✓
 $= \frac{300\ 000}{\sqrt{3} \times 22\ 000 \times 0.86}$ ✓
 $= \frac{32\ 770.201}{300\ 000}$
 $= 9.154\ A$ ✓ (3)

7.3 Through laminating✓ the core of a transformer, eddy currents are kept at a minimum✓, thus avoiding overheating of the core of the transformer. (2)

[10]

QUESTION 8

- 8.1
- A separately excited machine is one in which the DC supply to the field coils is separated from the connections to the armature.
 - The field coils are excited by a different supply than that of the armature.
- (2)

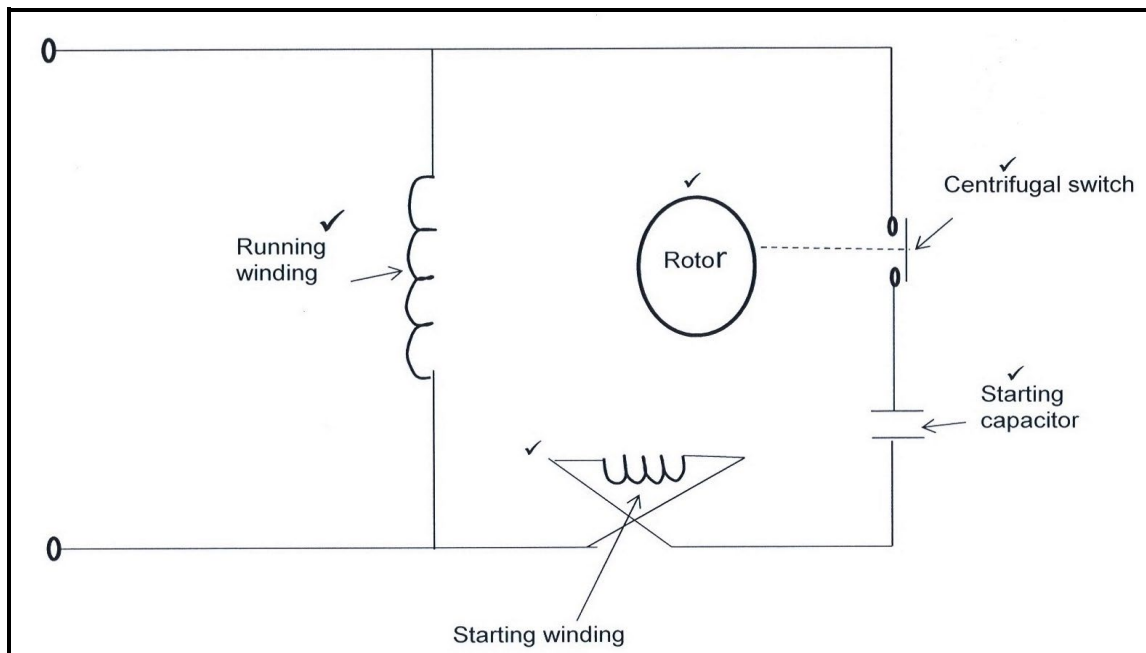


- 8.3
- 8.3.1 Field coils are connected in parallel with the armature
- 8.3.2 Field coils are connected in series with the armature
- 8.3.3 The compound motor has a set of shunt and series field coils connected in a long or short shunt.

(3 × 1) (3)
[10]

QUESTION 9

9.1



NOTE: A running winding can also be used to reverse the rotation of the motor shown in the circuit diagram above.

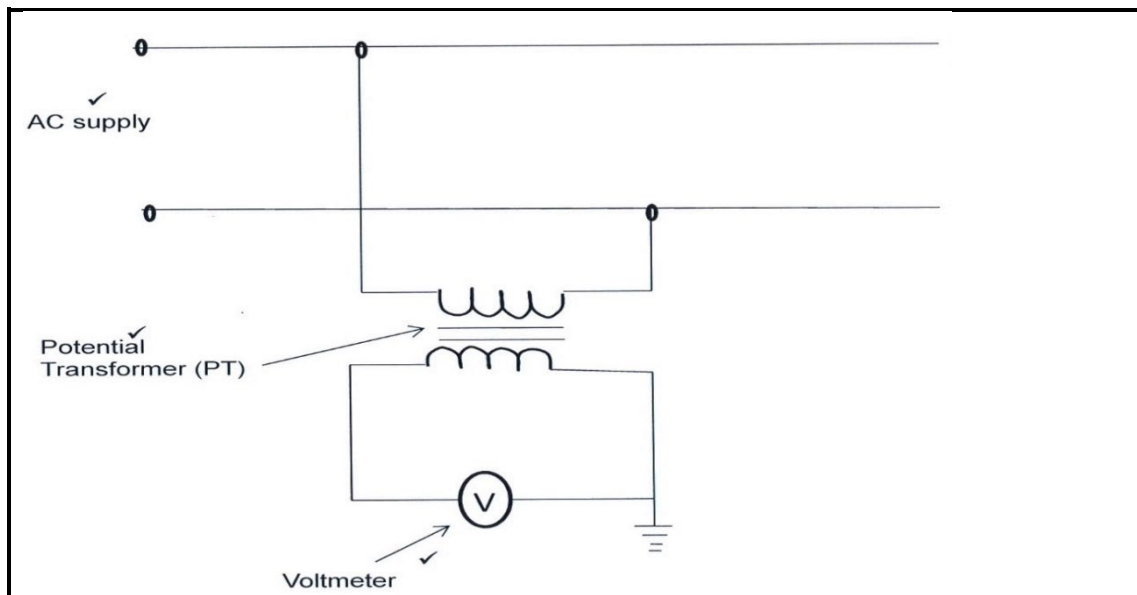
(5)

- | | | | |
|-----|-------|---|-----|
| 9.2 | 9.2.1 | Six terminals plus earth | (1) |
| | 9.2.2 | Star | (1) |
| | 9.2.3 | Delta | (1) |
| | 9.2.4 | It prevents the motor from being switched into the delta and star simultaneously. | (2) |

[10]

QUESTION 10

10.1



(3)

10.2

10.2.1 It increases / concentrates the magnetic attraction force when a coil nearly carries current.

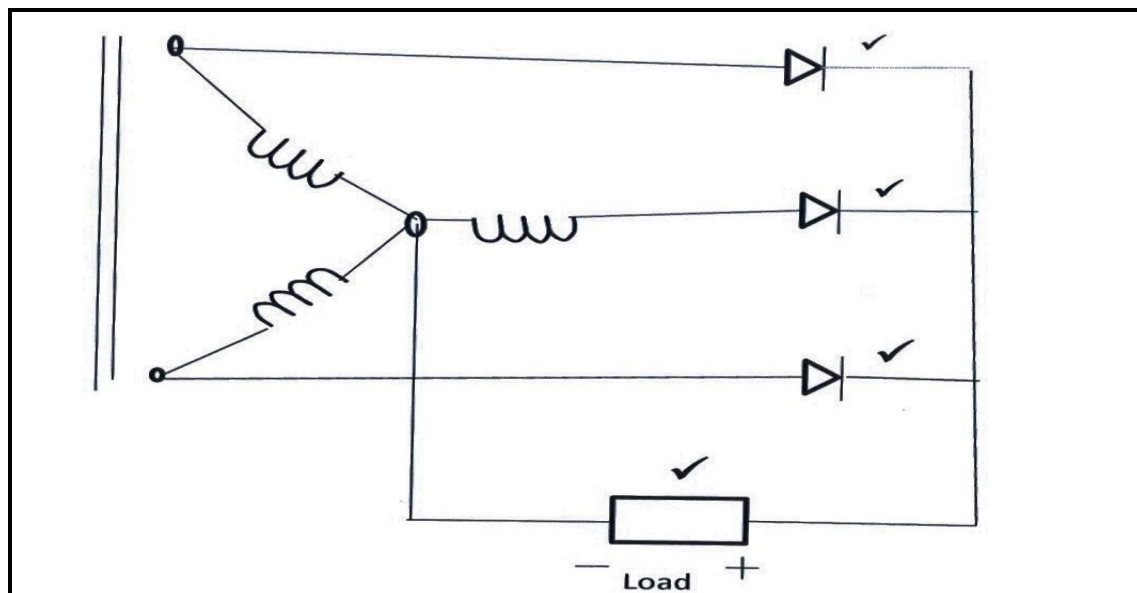
10.2.2 It provides a reverse torque against the deflecting torque.

10.2.3 It provides a permanent magnetic field which influences the moving- coil field.

(3 × 1)

(3)

10.3



(4)

[10]

TOTAL: 100