



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE APRIL EXAMINATION ELECTRICAL TRADE THEORY N2

4 APRIL 2016

This marking guideline consists of 7 pages.

QUESTION 1: CONDUCTORS AND CABLES

1.1 $P = \sqrt{3} \times V \times I \times \cos\Phi$ ✓
 $I = 200\,000 \div (380 \times 0,9)$ ✓
 $= 584,8 \text{ a}$ ✓ (3)

1.2 $I_{fc} = \frac{C I F \times A}{\sqrt{t}}$ ✓
 $= 62 \times 30 \div \sqrt{2}$ ✓
 $= 1,32 \text{ kA}$ ✓ (3)

- 1.3
- | | |
|-------|-------|
| 1.3.1 | True |
| 1.3.2 | False |
| 1.3.3 | False |
| 1.3.4 | False |
| 1.3.5 | True |
- (5 x 1) (5)
[11]

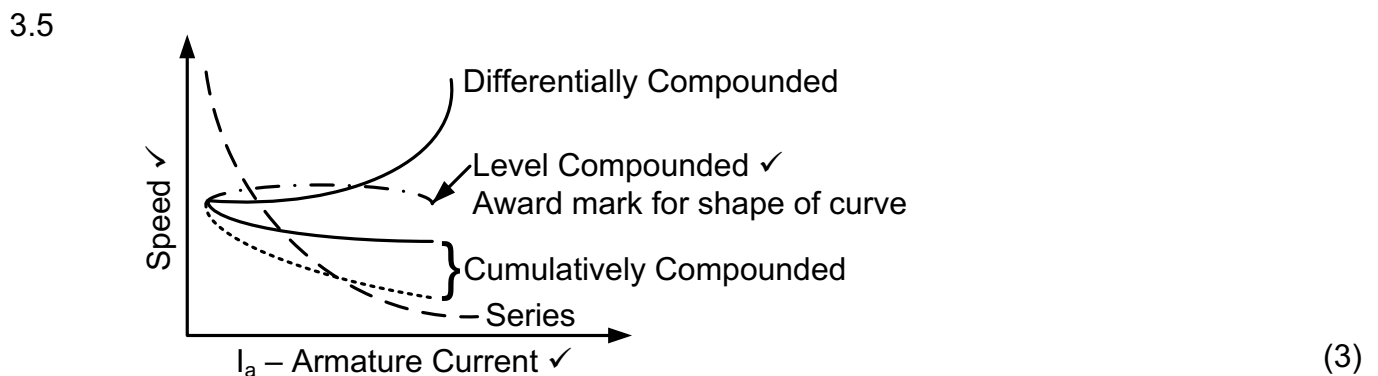
QUESTION 2: SWITCHGEAR, CONTACTORS AND RELAYS

- 2.1
- | | |
|-------|---|
| 2.1.1 | False✓, a disconnecter is known as an off-load isolator because it cannot open a highly inductive load at full voltage. |
| 2.1.2 | True✓, a switch-disconnector is known as an on-load isolator because it can open a highly inductive load at full voltage. |
| 2.1.3 | False✓, a switch-disconnector must be connected in the supply's live conductor. |
| 2.1.4 | False✓, overload current is defined as the current that flows when a fault other than a short circuit occurs. |
| 2.1.5 | True✓, an abnormally low ambient temperature will delay the tripping of thermal magnetic circuit breakers on overload. |
| 2.1.6 | True✓, a circuit breaker may be used as a disconnecter provided it complies with the standards of the relevant disconnectors. |
- (6 x 1) (6)

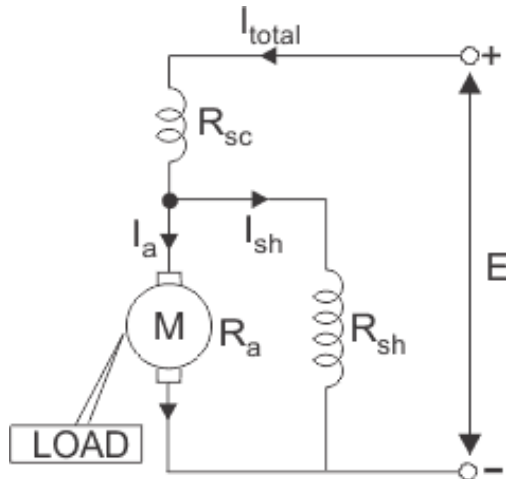
- 2.2 When the relay coil is magnetised✓, it attracts an iron armature✓. This movement closes or opens contacts.✓ (3)
- 2.3 Relays need a small current to be activated.✓ Contactors need a slightly larger current to be activated, but their contacts can carry a much larger current.✓ (2)
- 2.4 The coil.✓ (1)
- [12]

QUESTION 3: DC MOTORS AND STARTERS

- 3.1 3.1.1 The commutator is the termination of each field winding and it keeps the current of each field winding flowing in the same direction OR it connects the moving coil to the stationary brushes✓.
- 3.1.2 The brushes transfer currents to the rotating commutator.✓
- 3.1.3 The pole shoes increase the magnetic efficiency.✓ (3 x 1) (3)
- 3.2 An advantage of a compound motor is its high starting torque and safe no-load speed. (1)
- 3.3 The speed of a shunt motor is relatively constant with a varying load. (1)
- 3.4 Cranes and lifts, or where a high starting torque is required. (1)



3.6

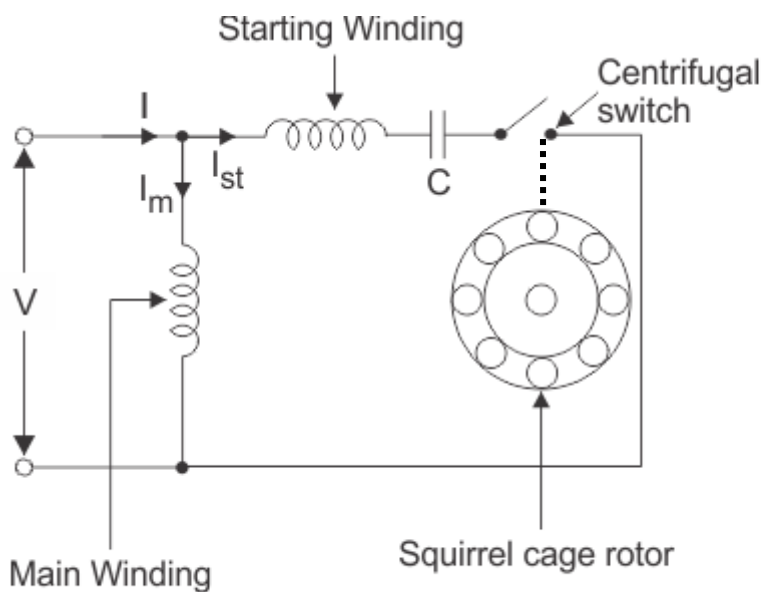


Sketch must show:

- Series Field Correctly drawn
- Shunt field correctly connected across armature
- Armature correctly connected to Short Shunt and Series Field

(3)
[12]**QUESTION 4: AC MOTORS AND STARTERS**

4.1



Sketch must show:

- Starter Winding, Capacitor and Centrifugal Switch in Series with each other.
- Run Winding must be parallel with the supply
- Centrifugal switch shown as connected to the Squirrel cage rotor / Rotor drawn in relation to the centrifugal switch.

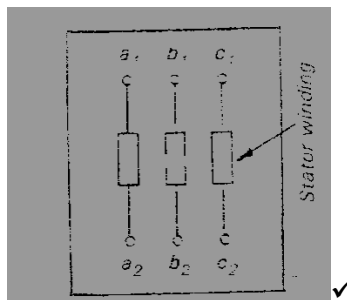
(3)

4.2

When the rotor speed and the synchronous speed is the same✓, there is no induction from the rotating magnetic field to the rotor.✓

(2)

- 4.3 4.3.1 At start-up, 3 resistors are connected✓ to the star-connected rotor windings.
- 4.3.2 When running at full speed, the resistors now measure 0 ohms or the rotor windings are short circuited. ✓
(2 x 2) (4)
- 4.4 4.4.1 Phase imbalance, thermal, overload and surge protection. ✓ (1)
- 4.4.2 Multi-phase motors should be protected against single phasing,✓ people should be protected against automatic start-up once supply has tripped.✓
(2 x 1) (2)
- 4.5



- An insulation resistance tester (megger) is connected between terminals a_1 and earth, then between b_1 and earth, then between c_1 and earth.✓
- Readings are taken and in each case they must be at least as high as recommended by the manufacturer (normally higher than 500 000 ohms).✓

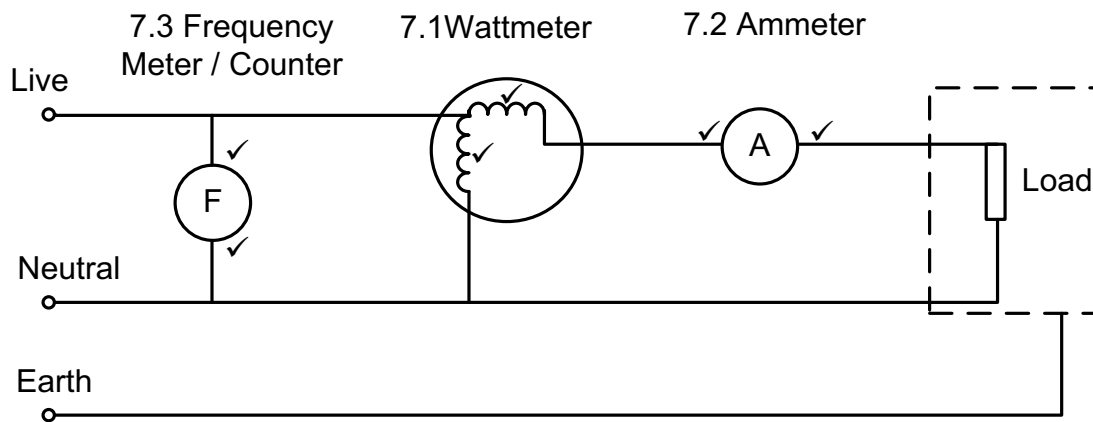
(3)
[15]**QUESTION 5: EARTHING**

- 5.1 • Stove
• Washing machine
• Fridge
• Freezer
• Metal exterior appliances
(Any 2 x 1) (2)
- 5.2 • To minimise the danger of being electrocuted ✓
• reduce touch voltage ✓
• Route fault currents down to earth. (2)
- 5.3 It must be bonded to earth. (1)
- 5.4 A conductor, including any clamp or terminal, that connects the consumers' earth terminal✓ electrically to the exposed conductive parts of an installation.✓ (2)

- | | | | | |
|-----|---|---|---------|-------------|
| 5.5 | 5.5.1 | Has a floating earth.✓ | | |
| | 5.5.2 | Braided conductor bolted onto the roof and gutters and clamped onto an earth rod✓ in the ground. | | |
| | 5.5.3 | A bare earth conductor must be drawn from the earth bar in the DB through the conduit and bonded to the face-plate✓ | (3 x 1) | (3) |
| 5.6 | Earth continuity conductors protect the phase lines against lightning and falling trees/objects. ✓ | | | (1) |
| 5.7 | Earth continuity conductors that are erected above overhead lines are connected to conducting structures✓ (pylons) and earthed via an earth continuity conductor or earth lead connected to an earth electrode in the ground. | | | (1) |
| | | | | [12] |

QUESTION 6: PROTECTION

- | | | | | |
|-----|---|---|---------|-------------|
| 6.1 | To discharge excessive / surge voltages down to earth✓ and to short circuit so that the surge does not damage any equipment✓ | | | (2) |
| 6.2 | In preventing excessive currents from flowing✓ the possibility of equipment melting and property catching fire / being damaged becomes less.✓ | | | (2) |
| 6.3 | When current in one phase is significantly less✓ than the other two phase currents, the secondary winding's EMF will be less and this can be used to trigger a tripping mechanism.✓ | | | (2) |
| 6.4 | In the live supply wire that feeds the circuit ✓ | | | (1) |
| 6.5 | As a switch. ✓ | | | (1) |
| 6.6 | 6.6.1 | The rapid opening of current carrying contacts✓ | | |
| | 6.6.2 | Reset that is done by hand. ✓ | (2 x 1) | (2) |
| | | | | [10] |

QUESTION 7: MEASURING INSTRUMENTS

NOTE: Sketches of candidates may look different

(3 x 2)

[6]**QUESTION 8: TRANSFORMERS**

8.1 8.1.1 $S = V_{\text{Secondary}} \times I_{\text{Secondary}}$ ✓
 $S = 24 \times 70$ ✓

$S = 1680 \text{ VA}$ ✓

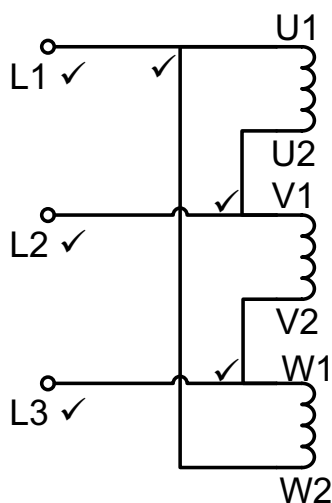
8.1.2 $\frac{N_{\text{Primary}}}{N_{\text{Secondary}}} = \frac{V_{\text{Primary}}}{V_{\text{Secondary}}}$ ✓
 $\frac{N_{\text{Primary}}}{N_{\text{Secondary}}} = \frac{220}{24}$ ✓

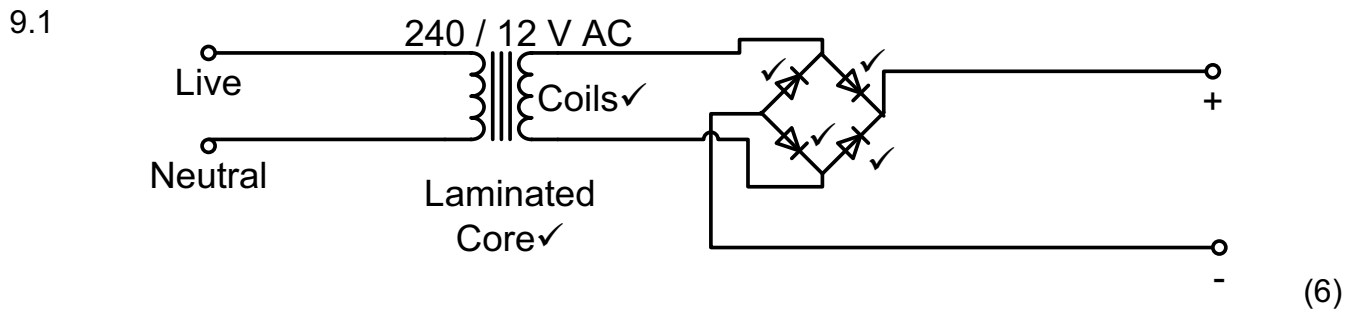
$\frac{N_{\text{Primary}}}{N_{\text{Secondary}}} = 9.167:1$ ✓

(3)

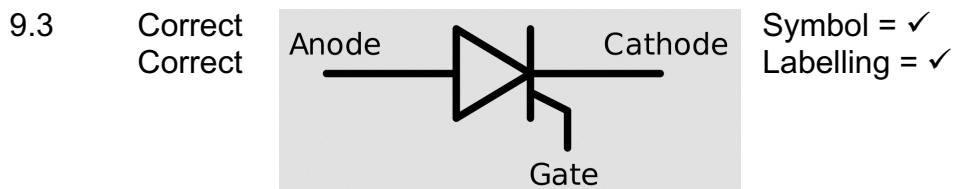
(3)

8.2

(6)
[12]

QUESTION 9: ELECTRONICS

- 9.2
- A switch
 - An amplifier
- (2 x 1) (2)



(2)
[10]
TOTAL: 100