higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ELECTRICAL TRADE THEORY N2

1 December 2023

This marking guideline consists of 7 pages.

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QUESTION 1: ALTERNATING CURRENT THEORY

1.1 1.1.1 B
1.1.2 D
1.1.3 E
1.1.4 C
1.1.5 A

(5 × 1) (5)

1.2 1.2.1 $P = VI\cos\theta$
$= 5{,}4 \times 230 \times 0{,}9$✓
$= 1117{,}8\,W$ ***OR*** $1{,}118kW$✓ (2)

1.2.2 $\theta = \cos^{-1} 0{,}9 = 25{,}842°$✓

$Q = VI\sin\theta$
$= 230 \times 5{,}4 \times \sin 25{,}842°$✓
$= 541{,}377\,VAr$✓ (3)

1.2.3 $S = VI$
$= 230 \times 5{,}4$✓
$= 1242\,VA$ ***OR*** $1{,}242kVA$✓ (2)
[12]

QUESTION 2: CONDUCTORS, INSULATORS AND CABLES

2.1 $I_{fc} = \dfrac{CIF \times A}{\sqrt{t}}$

$= \dfrac{62 \times 16}{\sqrt{4}}$ ✓✓

$= 496\,A$✓ (3)

2.2 2.2.1
- Construction of tubular heating found in kettles, ✓ urns, stoves and other heating appliances ✓
- Production of cartridge heaters, helical heaters,
- Thermocouple cables, fireproof cables
- High temperature crucibles, kiln furniture

(Any 2 × 1) (2)

2.2.2
- Manufacture switches and circuit breaker casings,✓ telephone casings,✓ automobile distributor caps.
- Electrical insulators, radio, telephone casings, kitchenware, jewellery, pipe stems, children's toys, firearms

(Any 2 × 1) (2)

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2.3 To make them waterproof✓ and to make it more difficult for dirt and water to settle.✓ (2)

2.4
- Relatively cheap
- Convenient to use
- Easy to terminate
- Readily available
- Lightweight
- Self-extinguishing
- Presents no drainage and sealing problems

(Any 3 × 1) (3)
[12]

QUESTION 3: SWITCHGEAR AND PROTECTIVE DEVICES

3.1
- Phase imbalance (current imbalance)
- Single phasing
- Phase reversal
- Phase sequence change
- Connector failure

(Any 2 × 1) (2)

3.2 In the event of a short circuit, the flux set up by the solenoid is strong enough regardless of the position of the piston✓ to attract the armature with enough force to activate the tripping mechanism instantaneously.✓ (2)

3.3
- Lightning
- Switching of large inductive loads
- Switching of capacitor banks
- Transient faults

(Any 3 × 1) (3)

3.4 It is to detect an earth fault current ✓and to automatically disconnect an installation or circuit from the supply✓, within a specified time, when it exceeds a specified or predetermined value. ✓

(3)
[10]

QUESTION 4: BATTERIES

4.1
- Motorcycles
- Marine equipment
- Wheelchairs
- Camcorders
- High-end motor vehicles
- Telecommunication industry
- Uninterrupted power suppliers

(Any 4 × 1) (4)

4.2
- High energy density
- Very low rate of self-discharge
- Low maintenance
- High cell voltage
- Many types available
- Small and lightweight
- Charges quickly
- Long lifespan
- Contain relatively low levels of toxic-heavy metals
- No memory effect

(Any 5 × 1) (5)

4.3 The recommended charging current is 20% of the rated current.✓ (1)
[10]

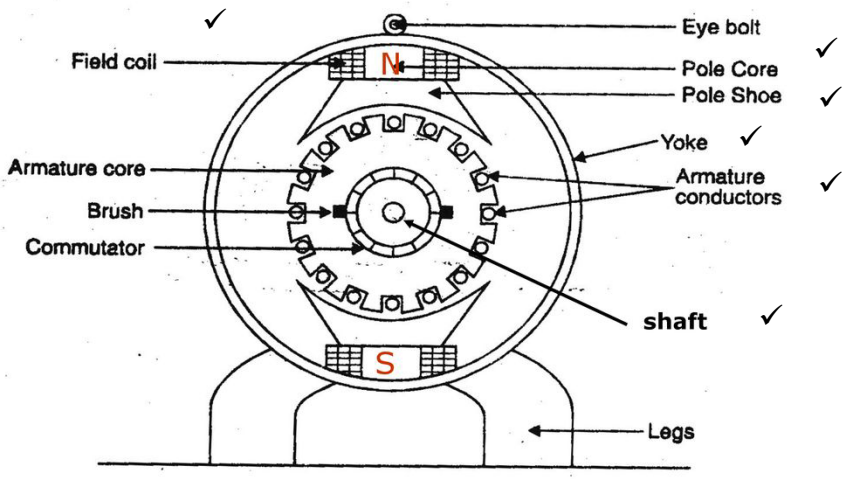
QUESTION 5: DC MACHINES

5.1
- To ensure reduced sparking or sparkless commutation.
- To neutralise the cross-magnetising effect of armature reaction. (2)

5.2
- Series-wound DC generators
- Shunt-wound DC generators
- Compound/series-parallel DC generators
- Long shunt generators
- Short shunt generators
- Differential compound generators
- Cumulative compound

(Any 2 × 1) (2)

5.3



(5 for labels + 1 for correct sketch) (6)

[10]

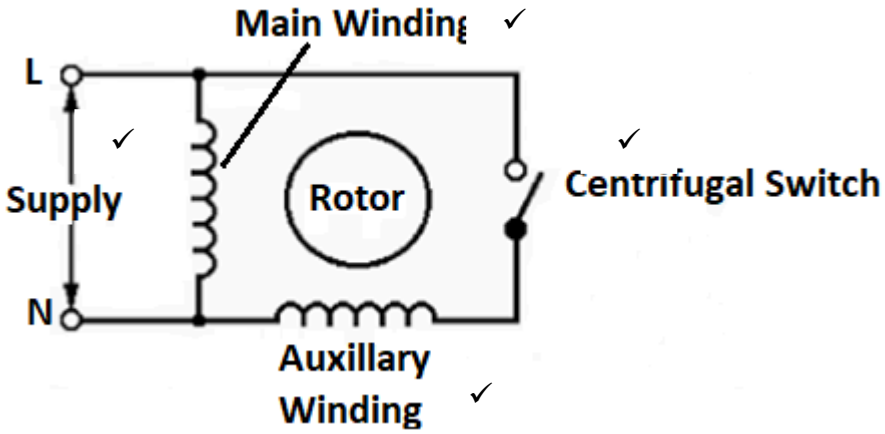
QUESTION 6: AC MACHINES

6.1 6.1.1 To check that there is a good electrical connection between the stator frame✓ and the earth stud inside the terminal box. ✓

6.1.2 To check the effectiveness of the insulation between the windings✓ and the earth stud or stator frame. ✓

(2 × 2) (4)

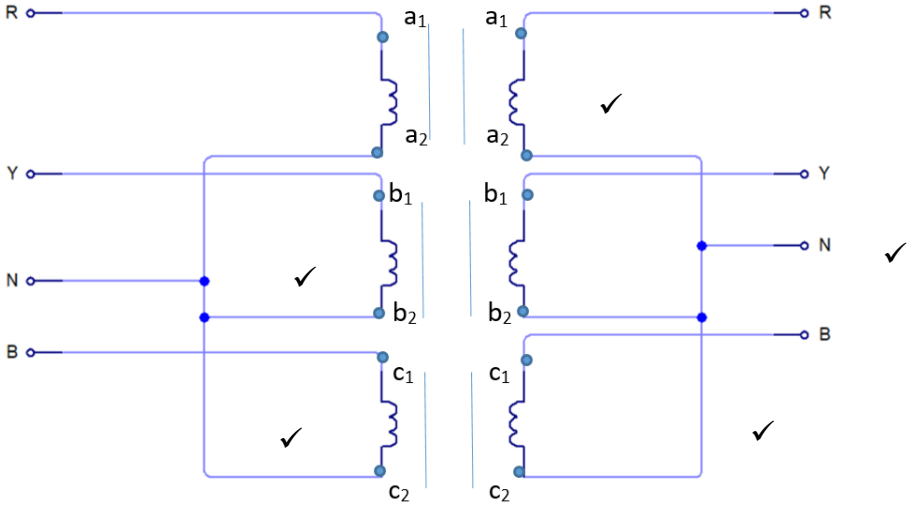
6.2



(4)
[8]

QUESTION 7: TRANSFORMERS

7.1



(5)

7.2 $I_0 = 4\ A$
$\emptyset_0 = 0{,}55$
$\emptyset_o = \cos^{-1}(0{,}55) = 56{,}633°$✓

$I_m = I_o \sin \emptyset_0$
$I_m = 4\sin(56{,}633°)$✓ $= 3{,}341A$ ✓

$I_c = I_o \cos \emptyset_0$ (5)
$I_c = 4 \cos(56{,}633°)\checkmark = 2{,}2A\checkmark$

[10]

QUESTION 8: EARTHING

8.1 8.1.1 True
8.1.2 True
8.1.3 True
8.1.4 False
8.1.5 False
8.1.6 True
8.1.7 True

(7 × 1) (7)

8.2 Earth leakage protection is not to be used as an alternative protective measure for earthing and bonding,✓ or the electrical separation of circuits.✓ Earth leakage protection is to be considered as an additional protective measure.✓ (3)

[10]

QUESTION 9: MEASURING INSTRUMENTS

9.1 A galvanometer is a sensitive moving-coil analogue instrument that is used to detect✓ and measure very small direct currents.✓ (2)

9.2 By using shunt and multiplier or series resistors in conjunction with the meter during measurement.✓ (1)

9.3 $R_m = 10\ \Omega,\ I_m = 0{,}05\ A,\ I_T = 8\ A$

$R_{sh} = \frac{I_m R_m}{I_T - I_m} = \frac{0{,}05 \times 10}{8 - 0{,}05}\checkmark\checkmark = 0{,}063\Omega\checkmark$ (3)

[6]

QUESTION 10: ELECTRICAL RETICULATION AND RENEWABLE ENERGY

10.1 10.1.1 Electrical reticulation network includes all conductors and infrastructure ✓which ensures the delivering of electrical energy to all points of consumption from all points of generation.✓

10.1.2 A feeder is a voltage power line transferring power✓ from a distribution substation to distribution transformers.✓

10.1.3 Renewable energy is natural sources of energy✓ that can be replenished naturally.✓

(3 × 2) (6)

10.2
- Biomass gas
- Geothermal energy
- Wind energy
- Solar energy
- Hydro-power energy

(Any 2 × 1) (2)

10.3
- Feeders can be supplied from both ends.
- Voltage drops and voltage fluctuations are minimised.
- More consumers can be supplied by a ring feeder system.
- Maintenance and repairs can be carried out on feeders without interrupting power to consumers.
- Supply to the consumers in not affected even when any feeder becomes out of service.

(Any 4 × 1) (4)
[12]

TOTAL: 100