higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

ARMATURE WINDING THEORY N2

9 April 2020

This marking guideline consists of 5 pages.

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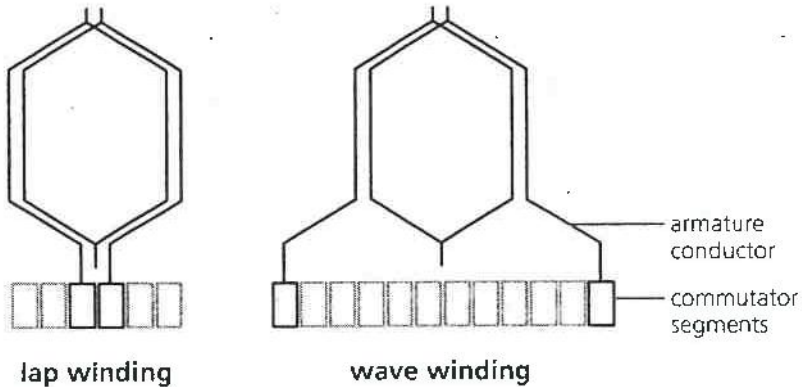
QUESTION 1

1.1 With lap windings the leads of each coil are connected approximately 180°✓ apart on the commutator whereas with wave windings the leads are connected in series next to each other.✓



(4 + 4) (8)

1.2 Coil span or coil pitch✓ is the number of slots occupied✓ from the first slot✓ the coil occupies till the end slot the other end of the coil occupies.✓ (4)

1.3 1.3.1 $$\text{Coil span} = \frac{\text{Total number of slots} + 1}{\text{Total number of poles}}$$

$$= \frac{115 + 1}{8}\checkmark$$

$$= 14{,}5$$

$$= 15\checkmark$$

1.3.2 $$\text{Commutator pitch} = \frac{\text{Number of segments} + 1}{\text{Number of pairs of poles}}$$

$$= \frac{345 + 1}{4}\checkmark$$

$$= 86{,}5$$

$$= 86\checkmark$$

(2 × 2) (4)

1.4 In a DC motor electrical energy is converted to mechanical energy and in a DC generator mechanical energy is converted to electrical energy. (2 + 2) (4)

[20]

QUESTION 2

2.1 Armature reaction is the distortion✓ of the main field flux✓ due to the cross-field armature carrying current conductors.✓ (3)

2.2 The reversal of current✓ in a coil has to take place while the two commutator segments✓ to which the coil is connected are being shorted circuited by a brush.✓ (3)

2.3 The function of interpoles is to counteract armature reaction✓ by cancelling the deformation of the resultant field✓ of the combined main and armature fields.✓ (3)

2.4 With multipolar lap-wound generators, the current will not be evenly shared✓ by various circuits unless the emfs induced have the same values for all circuits.✓ To avoid this, equalising windings or connectors are used to join various parts✓ of the circuits to create the same potential difference.✓ (4)

[13]

QUESTION 3

3.1 This technique is employed in small armatures✓ where each coil is physically wound✓ turn by turn to the completed amount of turns.✓✓

3.2 A former is made to the size of the old coil✓ which is then mounted onto an electric coil-winding machine✓ and the coil is prewound,✓ ready to be inserted as a coil into the coil slots.✓

3.3 This technique is employed where a coil is machine wound double✓ the size dimensions✓ of the original coil and slotted in tight at one end✓ then twisted at the other end and inserted over into the slots.✓

(3 × 4) **[12]**

QUESTION 4

4.1 4.1.1 $X_l = 2\pi fL$

$= 2 \times \pi \times 50 \times 10 \times 10^{-3}$✓

$= 3{,}142\ \Omega$✓✓ (3)

4.1.2 $Xc = \frac{1}{2\pi fC}$

$= \frac{1}{2 \times \pi \times 50 \times 20 \times 10^{-6}}$✓

$= 159{,}134\ \Omega$✓✓ (3)

4.1.3 $Z = \sqrt{R^2 + (Xc - Xl)^2}$

$= \sqrt{17^2 + (159{,}134 - 3{,}142)^2}$✓

$= 156\ \Omega$✓✓ (3)

4.1.4 $\cos\Theta = R/Z$

$= \cos^{-1} R/Z$✓

$= \cos^{-1} 17/156$✓

$= 83{,}74°$✓✓ (4)

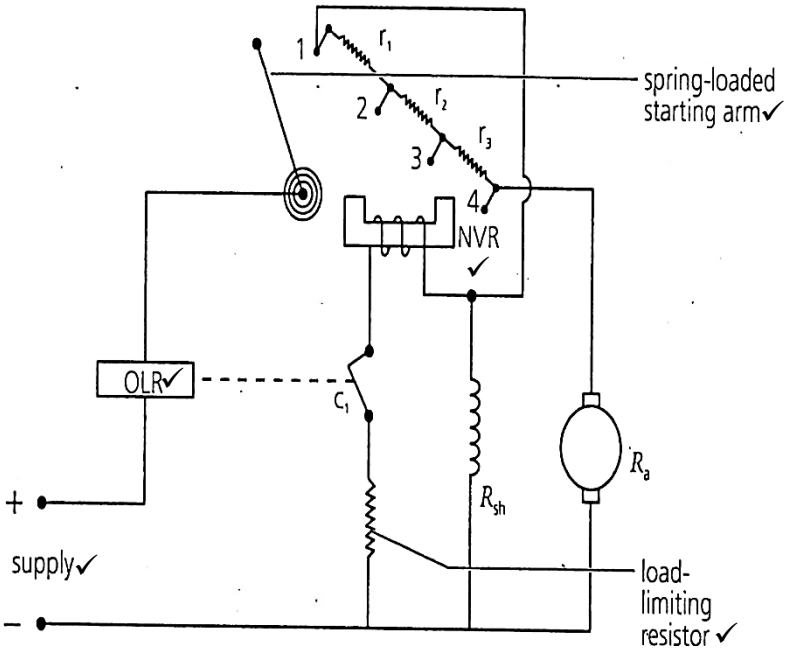
4.1.5 $I = V/Z$

$= 250/156$✓

$= 1{,}602\ A$✓✓ (3)

4.2 The function of the centrifugal switch is to disconnect the starting winding circuit✓ from the main supply circuit✓ in a single-phase motor once the motor has reached 75% of its rated full speed.✓ (3)
[19]

QUESTION 5



(5 for drawing + 5 for labels) **[10]**

QUESTION 6

6.1 A transformer is an electrical apparatus✓ that steps up✓ or steps down voltage.✓ (3)

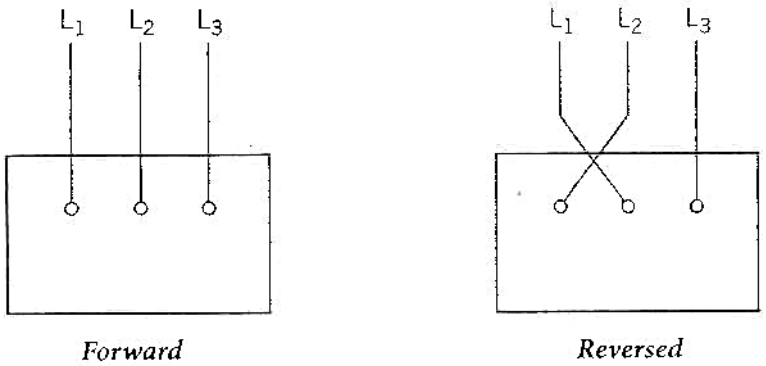
6.2 6.2.1 $V1/V2 = N1/N2$
$N1 = V1/V2 \times N2$✓
$= 220/10 \times 50$✓
$= 1\ 100$ turns✓✓ (4)

6.2.2 $V1/V2 = I2/I1$
$I2 = V1/V2 \times I1$✓
$= 220/10 \times 1,5$✓
$= 33$ A✓✓ (4)

6.2.3 $S = V1I1$
$= 220 \times 1,5$✓
$= 330$ VA✓✓ (3)
[14]

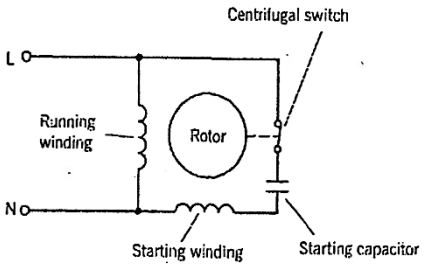
QUESTION 7

7.1



(3 for diagram + 3 for labels) (6)

7.2



(1 for diagram + 5 for labels) (6)
[12]

TOTAL: 100

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