higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T60**(E)**(A1)T

NATIONAL CERTIFICATE

ARMATURE WINDING THEORY N2

(11020042)

1 August 2018 (X-Paper)
09:00–12:00

Nonprogrammable calculators may be used.

This question paper consists of 4 pages and a formula sheet of 3 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
ARMATURE WINDING THEORY N2
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Leave at least TWO lines after each question.
5. Diagrams must be neat, labelled and large enough to show the required detail.
6. Write neatly and legibly.

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QUESTION 1

1.1 List THREE methods to minimise armature reaction. (3)

1.2 Why are brushes in DC machines made from carbon instead of steel? (3)

1.3 Make a neat labelled sketch of the construction of a DC machine. (8)

1.4 1.4.1 What is the function of a commutator in a DC motor?

1.4.2 What is the function of a commutator in a generator?

(2 x 2) (4)
[18]

QUESTION 2

2.1 A series circuit has a resistance of 12 ohms, an inductive reactance of 30 ohms and a capacitive reactance of 45 ohms, connected to a 220 V/50 Hz supply.

Calculate the following:

2.1.1 The impedance (2)

2.1.2 The current flow (2)

2.1.3 The volt drop across the coil (4)

2.1.4 Overall power factor (2)

2.1.5 Power used in the circuit (2)

2.2 2.2.1 What is the ideal power factor?

2.2.2 Give another term used to refer to ideal power factor.

(2 x 1) (2)
[14]

QUESTION 3

3.1 Describe the following methods of coil winding:

3.1.1 Hand winding

3.1.2 Form winding

3.1.3 Skein winding

(3 × 4) (12)

3.2 Explain THREE methods of closing slots after the windings have been inserted. (3)

3.3 What is the purpose of mica in the commutator? (2)
[17]

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QUESTION 4

4.1 Explain in detail the difference between a *squirrel cage rotor* and a *wound rotor*. (6)

4.2 List THREE faults commonly found in armature coils. (3)

4.3 How are coil turns accurately determined when recording data before winding? (2)

4.4 Explain in detail why the core of a transformer is laminated. (3)

4.5 What is the purpose of a transformer? (2)

4.6 Name and explain the methods used to cool a transformer. (4)
[20]

QUESTION 5

5.1 Name TWO practical tests that can be conducted on an armature to locate short circuit or open circuit. (2)

5.2 List FOUR performance tests that can be conducted on a DC machine (4)

5.3 State Flemming's Left Hand rule. (4)

5.4 Explain the terms *differentially compounded* and *cumulatively compounded.* (2)
[12]

QUESTION 6

6.1 When dismantling a motor that has not been opened before, explain the procedure you will follow for the motor to be re-assembled correctly. (6)

6.2 Give FIVE reasons why a roller bearing wears out. (5)
[11]

QUESTION 7

7.1 Name THREE types of insulating materials used for slot boxes and caps. (3)

7.2 What is heat shrink sleeving and how is it installed? (5)
[8]

TOTAL: 100

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ARMATURE WINDING N2

FORMULA SHEET

1. $\dfrac{Total\ number\ of\ slots + 1}{Total\ number\ of\ poles} = COIL\ SPAN$

   $\dfrac{Totale\ aantal\ gleuwe + 1}{Totale\ aantal\ pole} = SPOELSPAN$

2. $COMMUTATOR\ PITCH = \dfrac{Number\ of\ segments \pm 1}{Number\ of\ pairs\ of\ poles}$

   $KOMMUTATORSTEEK = \dfrac{Hoeveelheid\ segmente \pm 1}{Hoeveelheid\ poolpare}$

3. $E = \dfrac{Total\ flux\ of\ pole}{Time\ of\ one\ revolution}$

   $= 2p\ \phi \div \dfrac{60}{N}$

   $= \dfrac{2\ \phi NP}{60}\ volt$

   $E = \dfrac{Totale\ vloed\ van\ pole}{Duur\ van\ een\ omwentelin\,g}$

   $E = \dfrac{2\ ZNP\ \varphi}{C \times 60}$

   $Z = \dfrac{EXC \times 60}{2\ NP\ \varphi}$

   $MECHANICAL\ POWER = \dfrac{Force \times distance}{Time\ in\ seconds}$

   $= 2\ \pi\ metres$

   $\therefore\ P = F \times 2\ \pi\ R \times \dfrac{N}{60}$

   $= \dfrac{2\ \pi\ NT}{60}\ watts$

   $MEGANIESE\ DRYWING = \dfrac{Krag \times afstand}{Tyd\ in\ sekondes}$

   $E = V + Ia\ Ra\ or/of\ E = V - Ia\ Ra$

   $V = E + Ia\ Ra$

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SUMMARY

$E = \frac{2\ ZNP\phi}{C \times 60}$

$T = \frac{ZP\phi Ia}{C \times \pi}$

$A = \frac{I}{J}$

$E = V + Ia\ Ra \quad A\ max/maks = \frac{Ia}{J\ \min}$

$Ia = I + If \quad A\ min = \frac{Ia}{J\ max/maks}$

$P = EIa$

$Lt = Z \times \frac{Length\ \ per\ turn}{2}$

$Lt = Z \times \frac{Lengte\ \ per\ \ draai}{2}$

$Ra = Zx\ \underline{Length\ per\ turn \times Resistance\ per\ unit\ x}\ \frac{1}{C^2}$

$Ra = Zx\ \underline{Lengte\ per\ draai \times Weerstand\ per\ eenheid\ x}\ \frac{1}{C^2}$

RECTANGULAR CONDUCTORS
REGHOEKIGE GELEIERS $R = \frac{\rho\ell}{A}$

$Ra = \frac{1t \times resistance\ \ per\ unit\ length}{C^2}$

$Ra = \frac{1t \times weerstand\ \ per\ \ eenheidlengte}{C^2}$

$A\ max = \frac{Ia}{J\ \min}$ $\qquad$ $A\ maks = \frac{Ia}{J\ \min}$

$A\ min = \frac{Ia}{J\ \max}$ $\qquad$ $A\ min = \frac{Ia}{J\ maks}$

$n = f/p$

$QV^2 = QR^2 + QL^2$ $\qquad$ $\frac{VP}{VS} = \frac{NP}{NS} = \frac{IS}{IP}$

$V^2 = (IR)^2 + (I \times L)^2$

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$$V = I\sqrt{R^2 \times L^2}$$

$$\frac{V}{I} = \sqrt{R^2 \times L^2}$$

$$XL = 2\pi FL$$

$$I = \frac{V}{2}$$

$$Z = \sqrt{R^2 + XL^2}$$

$$C = \frac{Q}{V}$$

$$X_C = \frac{1}{2\pi fc}$$

$$XC = \frac{V}{I} = \frac{1}{2\pi} FC$$

$$C = \frac{1}{2\pi} FXc$$

$$Z = \sqrt{R^2 + (XC \quad XL)^2}$$

$$Cos\ \phi = \frac{R}{Z}$$

Ip Np = Is Ns

$$\frac{Ip}{Is} = \frac{Ns}{Np}$$

$$Current = \frac{Apparent\ \ power\ .\ Ps}{Potential\ \ difference\ .\ V}$$

$$Stroom = \frac{Skyndrywing\ .\ Ps}{Potensiaalverskil\ .\ V}$$

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