higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

ELEKTROTEGNIEK N4

19 November 2024

Hierdie nasienriglyn bestaan uit 7 bladsye.

Kopiereg voorbehou

VRAAG 1

1.1
1.1.1 struktuur
1.1.2 magnetobeweegkrag
1.1.3 reluktansie
1.1.4 direk
1.1.5 trek aan
1.1.6 selfinduktansie
1.1.7 lading
1.1.8 chemiese
1.1.9 hoof-
1.1.10 diëlektrikum

(10 × 1) (10)

1.2 Data:

$R_1 = x =?$, $V = 110\ V$
$R_2 = 20\ \Omega$, $I_4 = 2\ A$
$R_3 = 30\ \Omega$
$R_4 = 50\ \Omega$

$V_2 = I_4 R_4 = 2x50 = 100\ V$✓= V3 [parallel]

$I_3 = \frac{V_2}{R_3} = \frac{100}{30} = 3{,}3\ A$✓

$I_T = I_3 + I_4 = 3{,}3 + 2 = 5{,}3\ A$✓

$V_1 = V_T - V_2 = 110 - 100 = 100\ V$✓

$I_2 = \frac{V_1}{R_2} = \frac{10}{20} = 0{,}5\ A$✓

$I_1 = I_T - I_2 = 5{,}3 - 0{,}5 = 4{,}8\ A$✓

$R_1 = x = \frac{V_1}{I_1} = \frac{10}{4{,}8} = 2{,}083\ A$✓

$Q_1 = {I_1}^2 R_1 t = 4{,}8^2 x2{,}083x36 = 1727{,}724\ J$✓✓ (9)

1.3 Data:

$C_1 = 90\ \mu F$
$C_2 = 40\ \mu F$
$C_3 = 70\ \mu F$
$C_4 = 35\ \mu F$
$V_T = 110\ V$

1.3.1 $C_{P1} = C_1 + C_2 = 90 + 40 = 130\ \mu F$✓
$C_{P2} = C_3 + C_4 = 70 + 35 = 105\ \mu F$✓
$C_T = \frac{C_{P1} x C_{P2}}{C_{P1} + C_{P2}} = \frac{130x105}{130+105} = 58{,}085\ \mu F$✓✓ (4)

1.3.2 $Q_T = C_T V_T = 58{,}085x10^{-6}x110 = 6{,}389\ mC$✓
$V_1 = \frac{Q_T}{C_{P1}} = \frac{6{,}389x10^{-3}}{130x10^{-6}} = 49{,}146\ V$✓
$V_2 = \frac{Q_T}{C_{P2}} = \frac{6{,}389x10^{-3}}{105x10^{-6}} = 60{,}848\ V$✓ (3)

1.3.3 $Q_1 = C_1 V_1 = 90x10^{-6}x49{,}146 = 4{,}423\ mC$✓
$Q_2 = C_2 V_1 = 40x10^{-6}x49{,}146 = 1{,}966\ mC$✓
$Q_3 = C_3 V_2 = 70x10^{-6}x60{,}848 = 4{,}259\ mC$✓
$Q_4 = C_4 V_2 = 35x10^{-6}x60{,}848 = 2{,}129\ mC$✓ (4)

[30]

VRAAG 2

2.1
- Hysers
- Lugkompressors
- Stofsuiers
- Trolliemotors
- Krane
- Treine
- Elektriese lokomotiewe

(Enige 3 × 1) (3)

2.2 2.2.1 Dis om die motor outomaties af te sny van die toevoer in gevalle waar die toevoerspanning tot onder die gegradeerde waarde val.

2.2.2 Dis om die motor outomaties af te sny van die toevoer in gevalle van oorlading of kortsluitings.

(2 × 2) (4)

2.3 Data:

$p = 3$ $c = 2p = 6$
$V = 300\,V$ $I_L = 25\,A$
$R_a = 0{,}2\,\Omega$ $R_{sh} = 100\,\Omega$
$\phi = 20\,mWb$ $75\ gleuwe$
$N = 1\,300\,r/min$ $Geleiers\ per\ gleuf = ?$

$I_{sh} = \frac{V}{R_{sh}} = \frac{300}{100} = 3\,A$✓

$I_a = I_L - I_{sh} = 25 - 3 = 22\,A$✓

$E = V - I_a R_a$
$= 300 - [(22)(0{,}2)]$✓
$= 295{,}6\,V$✓

$Z = \frac{60Ec}{2Np\phi}$

$= \frac{60\ x\ 295{,}6\ x\ 6}{2\ x\ 1300\ x\ 3\ x\ 20x10^{-3}}$✓✓

$= 682{,}154$✓

$= 682\ geleiers$

$Geleiers\ per\ gleuf = \frac{Z}{gleuwe}$
$= \frac{682}{75} = 9{,}093 = 9\ gleuwe$ ✓ 9 geleiers/gleuf (8)

2.4 Data:

$V = 400\,V$
$p = 2$
$c = 2\ (golf)$
$Z = 470$
$R_{sh} = 150\,\Omega$
$T = ?$
$\phi = 25\,mWb$
$I_L = 55\,A$

$I_{sh} = \frac{V}{R_{sh}}$
$= \frac{400}{150} = 2{,}6\,\Omega$ ✓

$I_a = I_L - I_{sh}$
$= 55 - 2{,}6 = 52{,}4\,A$ ✓

$T = \frac{0{,}318 I_a \phi p Z}{c}$
$= \frac{0{,}318\ x\ 52{,}4\ x\ 2\ x\ 470\ x25x10^{-3}}{2}$✓✓
$= 195{,}793\ Nm$ ✓ (5)

[20]

VRAAG 3

$X_{L(A)} = 2\pi fL = 2\pi(50)(100x10^{-3}) = 31{,}416\ \Omega$✓
$Z_A = R + jX_L = 20 + j31{,}416 = 37{,}242\angle 57{,}518^0\ \Omega$✓

$X_{L(B)} = 2\pi fL = 2\pi(50)(200x10^{-3}) = 62{,}832\ \Omega$✓
$Z_B = R + jX_L = 36 + j62{,}832 = 72{,}415\angle 60{,}189^0\ \Omega$✓

$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi(50)(55x10^{-6})} = 57{,}875\ \Omega$ ✓
$Z_C = R - jX_C = 30 + j57{,}875 = 65{,}188\angle -62{,}6^0\ \Omega$✓

$Z_B + Z_C = 66 + j4{,}957 = 66{,}186\angle 4{,}295^0\ \Omega$✓✓
$Z_P = \frac{Z_B\ x\ Z_C}{Z_B + Z_C} = 71{,}323\angle -6{,}706^0 = 70{,}835 - j8{,}329\ \Omega\ \Omega$✓✓

$Z_T = Z_A + Z_P = 90{,}835 + j23{,}087 = 93{,}723\angle 14{,}261^0\ \Omega$✓✓

$I_T = \frac{V_T}{Z_T} = \frac{200\angle 0^0}{93{,}723\angle 14{,}261^0} = 2{,}134\angle -14{,}261^0 A$ ✓✓

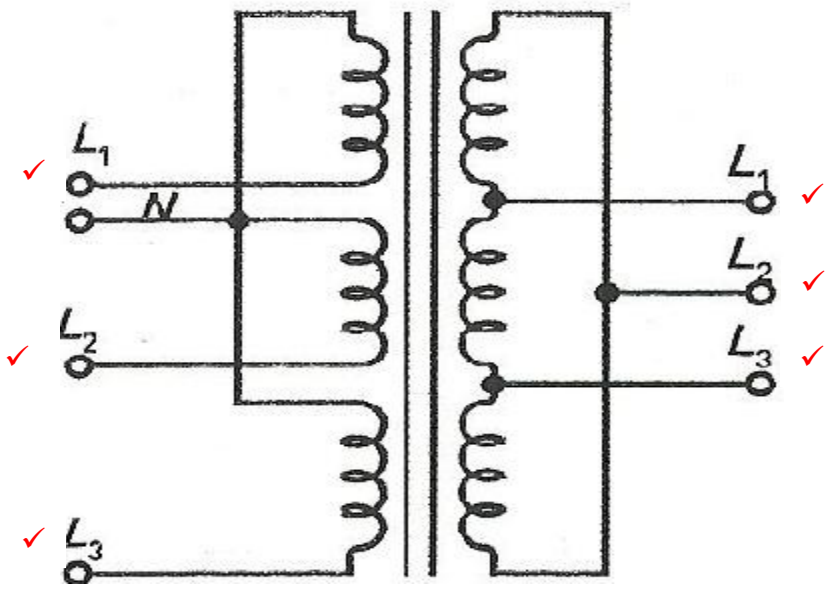
$V_{Coil1} = I_T . Z_A = 2{,}134\angle -14{,}261^0 x\ 37{,}242\ \angle 57{,}518^0 = 79{,}474\angle 43{,}257^0\ V$✓✓
$V_{Coil2} = I_T . Z_P = 2{,}134\angle -14{,}261^0 x\ 71{,}323\ \angle -6{,}706^0 = 152{,}203\angle -20{,}967^0\ V$✓✓

$I_B = \frac{V_{Coil2}}{Z_B} = 2{,}102\angle -81{,}156\ A$✓
$I_C = \frac{V_{Coil2}}{Z_C} = 2{,}335\angle 41{,}633\ A$✓

[20]

VRAAG 4

4.1



Korrekte diagram (2 punte)
Enige 4 korrekte byskrifte (4 punte) (6)

4.2 Data:

$V_1 = 222\ V = E_1$
$V_2 = 2\ 220\ V = E_2$
$f = 50\ Hz$
$A = 100cm^2 = 100x10^{-4}\ m^2$
$N_1 = 200\ windings$

$\phi_m = \frac{E_1}{4{,}44fN_1}$
$= \frac{222}{4{,}44x50x200}$✓
$= 0{,}005\ Wb\ or\ 5\ mWb$✓

$\beta_m = \frac{\phi_m}{A}$
$= \frac{0{,}005}{100x10^{-4}} = 0{,}5\ Tesla$✓

$N_2 = \frac{V_2\ xN_1}{V_1}$
$= \frac{2220x200}{222} = 2\ 000\ windings$✓ (4)

[10]

VRAAG 5

5.1 Data:

$p = 3$
$N_r = 400\ r/m$
$V = 410\ v$
$f = 50\ Hz$

5.1.1 $N_s = \frac{60f}{p}$
$= \frac{60\ x\ 50}{3}$
$= 1\ 000\ r/m$ ✓

$Glippersentasie = \frac{N_s - N_r}{N_s}$
$= \frac{1\ 000-400}{1\ 000}x100$✓
$= 60\%$✓ (3)

5.1.2 $Per - eenheid\ glip = \frac{N_s - N_r}{N_s}$
$= \frac{1\ 000-400}{1\ 000}$
$= 0{,}6$ ✓ (1)

5.2 Om die draairigting om te keer:

5.2.1 Deur enige twee van die drie fases om te ruil (rooi, geel en blou).

5.2.2 Deur óf die verbinding van die loopwikkeling óf die verbinding van die aansitwikkeling te verander,✓ maar nie albei gelyktydig nie.✓

5.2.3 Deur die polariteit oor die anker of veldspoele te verander.

(6)
[10]

VRAAG 6

6.1 A − Ontwikkeling
B − Transmissie
C − Distribusie
D − Voerder
E − Benutting (5)

6.2 6.2.1 D
6.2.2 A
6.2.3 F
6.2.4 E
6.2.5 B

(5 × 1) (5)
[10]

TOTAAL: 100

Kopiereg voorbehou