higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

ELEKTROTEGNIEK N4

XX Augustus 2021

Hierdie nasienriglyn bestaan uit 7 bladsye.

Kopiereg voorbehou

VRAAG 1: BEGINSELS VAN ELEKTRISITEIT

1.1
1.1.1 B
1.1.2 E
1.1.3 A
1.1.4 C
1.1.5 D
1.1.6 C
1.1.7 E
1.1.8 A
1.1.9 D
1.1.10 B

(10 x 1) (10)

1.2 **Data:**

$P = 40W$
$I_1 = 2A$
$R_1 = ?$
$R_2 = 20\Omega$
$I_2 = ?$
$R_3 = ?$
$V_t = 32V$

$P = I^2R$
$R_1 = P/I^2 = 40/2^2 = 10\ \Omega$✓

$V_P = IR = 2 \times 10 = 20\ V$✓

$I_2 = V_2/R_2 = 20/20 = 1\ A$✓

$I_t = 2 + 1 = 3\ A$✓

$V_X = V_T - V_P = 32 – 20 = 12\ V$✓

$V_x = I_T \times R_3$
$12 = 3 \times R_3$
$R_3 = 4\ \Omega$✓ (6)

1.3 1.3.1
- Koper
- Aluminium
- Yster
- Goud
- Silwer (Enige 2 × 1)

1.3.2
- Glas
- Plastiek
- Papier
- Rubber (Enige 2 × 1)

(2 × 2) (4)

1.4 1.4.1 **Oorweeg Lus 1:**

$V_1 = I_1R_1 + I_3R_3$

$10 = 10I_1 + 40I_3$

$10 = 10I_1 + 40(I_1 + I_2)$

$10 = 50I_1 + 40I_2$.....(1) ✓

Oorweeg Lus 2:

$V_2 = I_2R_2 + I_3R_3$

$20 = 20I_2 + 40I_3$

$20 = 20I_2 + 40(I_1 + I_2)$

$20 = 40I_1 + 60I_2$.....(2) ✓

Oorweeg Lus 3:

$V_2 - V_1 = I_2R_2 - I_1R_1$

$20 - 10 = 20I_2 - 10I_1$ ✓

$10 = -10I_1 + 20I_2$.....(3) ✓

(1) x 60:

$10 = 50I_1 + 40I_2$

$600 = 3000I_1 + 2400I_2$.....(4)

(2) x (-40):

$20 = 40I_1 + 60I_2$

$-800 = -1600I_1 - 2400I_2$.....(5)

(4) + (5):

$600 = 3000I_1 + 2400I_2$

$-800 = -1600I_1 - 2400I_2$

$-200 = 1400I_1$

$I_1 = -0,143A$ ✓✓ (6)

1.4.2 **Substitueer I_1 in (1):**

$10 = 50I_1 + 40I_2$

$10 = [50x(-0,143) + 40I_2$ ✓✓

$I_2 = 0,429A$ (2)

1.4.3 $I_3 = I_1 + I_2 = -0,143 + 0,429 = 0,286A$ ✓✓ (2)

[30]

VRAAG 2: GS-MASJIENE

2.1 **Gegee:**
p = 4
c = 2 x 4 = 8
N = 450 r/p
E = 250 V
Φ = 0,05 Wb

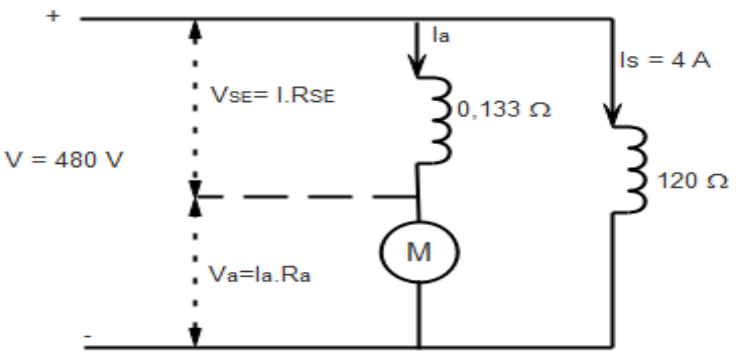
$$E = \frac{2ZNp\phi}{60c}$$

$$Z = \frac{60x250x8}{2x450x4x0,05}$$ ✓✓

$$Z = 666,667 = 667$$ ✓

$$Geleiers/gleuf = \frac{Geleiers}{Gleuwe} \quad {}^{s}/_{-} = \frac{667}{120} = 5,558$$ = 6 geleiers per gleuf✓✓ (5)

2.2 2.2.1



½ punt per benoeming × 8 = 4
1 punt vir kringdiagram × 1 = 1 (5)

2.2.2 **Gegee:**
R_a = 0,2 Ω I = 40 A
R_{se} = 0,133 Ω V = 480 V
R_{sh} = 120 Ω

$$I_S = \frac{V}{R_S} = \frac{480}{120} = 4A$$ ✓

$$I_a = I_L - I_S = 40 - 4 = 36A$$ ✓

$$V = E + I_aR_a + I_aR_{se}$$
480 = E + (36)(0,2) + (36)(0,133)✓
480 = E + 7,2 + 4,788✓
E = 468 V✓ (5)

2.3 **Gegee:**

$R_{aanvang}$ = ?, $I_{aanvang} = 1,5I_{FL}$
V = 400 V, R_a = 0,35 Ω
P = 12 kW,

I = P/V = 12 000/400 = 30 A ✓

$I_{aanvang} = 1,5\ I_{FL} = 1,5 \times 30$
= 45 A✓

$R_T = V/I_{aanvang} = 400/45$
= 8,889 Ω✓

$R_{aanvang} = R_T - Ra = 8,889 - 0,35$✓
= 8,539 Ω✓ (5)
[20]

VRAAG 3: WS-TEORIE

3.1
- Een siklus is een herhaling van die WS-stroomsein.
- Die tyd wat dit neem om een siklus te voltooi word die tydsduur (T) genoem. (2)

3.2 V = 200 V
f = 50 Hz

3.2.1
$$Z_1 = 6 + j4 = 7,211\angle 33,69°$$
$$Z_2 = 4 - j2 = 4,472\angle -26,55°$$
$$Z_T = Z_1 + Z_2$$
$$Z_T = 10 + j2 = 10,198\angle 11,31°$$ ✓✓

$$I = \frac{V}{Z_T} = \frac{200}{10,198} = 19,61\angle -11,31°$$ ✓✓

$P = I^2R = 19,61^2\ x\ 10 = 3,85\ kW$✓

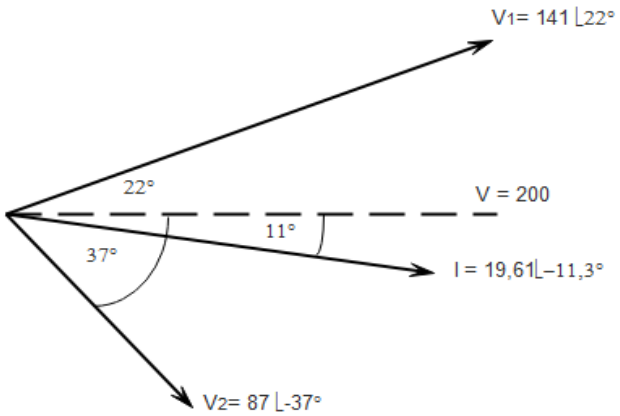
$S = V_T\ x\ I_T = 200\ x\ 19,61 = 3,92\ kVA$✓ (6)

3.2.2 Arbeidsfaktor = Cos ∅
= Cos 11,31º✓
= 0,98 naloop✓ (2)

3.2.3
$$V_1 = IZ_1 = (19,61\angle -11,31°)(7,211\angle 33,69°)$$
$$V_1 = IZ_1 = 141,4\angle 22,38°$$ ✓✓

$$V_2 = IZ_2 = (19,61\angle -11,31°)(4,472\angle -26,55°)$$
$$V_2 = IZ_2 = 87,696\angle -37,86°$$ ✓✓ (4)

3.2.4



Korrekte fasordiagram = 1
Enige korrekte hoek (1 × 1) = 1
Enige TWEE korrekte waardes (2 × 1) = 2 (4)

3.3 **Gegee:**

P = ? I = 10 A
V = 250 V Cos ø = 0,8
f = 50 Hz

P = VI Cos ø
= (250)(10)(0,8)✓
= 1,44 kW✓ (2)
[20]

VRAAG 4: TRANSFORMATORS

4.1
- Geen koperverlies
- Geen histereseverlies
- Geen vloedlekkasie
- Geen vervorming
- 100% rendement
- Oneindige permeabiliteit (Enige 5 × 1) (5)

4.2 **Data:**

$S = 4,4kVA$
$f = 50Hz$
$V_1 = E_1 = 440V$
$V_2 = E_2 = 120V$
$N_2 = 48$

4.2.1 $\frac{V_1}{V_2} = \frac{N_1}{N_2}$ ✓

$N_1 = \frac{48x440}{120} = 176$ (1)

4.2.2 $VA = I_1V_1$ $VA = I_2V_2$

$4400 = I_1x440$ ✓ $4400 = I_2x120$ ✓

$I_1 = 10A$ $I_2 = 36,67A$ (2)

4.2.3 $E_1 = 4,44\phi_m fN_1$

$E_2 = 4,44\phi_m fN_2$

$120 = (4,44)(\phi_m)(50)(48)$ ✓

$\phi_m = 0,01126Wb = 11,26mWb$ ✓ (2)

[10]

VRAAG 5: WS-MASJIENE

5.1 5.1.1 $Nr = Ns(1 - s) = 1500(1 - 0,2) = 1200\ rpm$✓✓

5.1.2 $p = \frac{f}{ns} = \frac{50}{25} = 2\ poolpare$ ✓

Pole = 2 poolpare × 2 = 4 pole ✓

(2 × 2) (4)

5.2 Glip (1)

5.3 Namate die rotor 70% tot 80% van die sinchrone spoed bereik,✓ ontkoppel die sentrifugale skakelaar die aansitwikkeling van die toevoer.✓ (2)

5.4 Splitfasemotors met kapasitoraansitting word gebruik wanneer die aansitlas hoog is.✓

Dit word algemeen gebruik in:

- yskaste
- outomatiese wasmasjiene
- kompressors
- pompe
- vervoerbande. (Enige 2 × 1 + 1) (3)

[10]

VRAAG 6: ONTWIKKELING EN TOEVOER VAN WS-KRAG EN MEETINSTRUMENTE

6.1

1. Kragstasie
2. Transmissielyne
3. Substasie
4. Verlagingstransformator (punt mag ook vir distribusielyn toegeken word)
5. Verbruikers (5)

6.2 Wattmeter (1)

6.3

- Stroomspoel word oor 'n sjuntresistor gekoppel.
- Spanningspoel word in serie met 'n vermenigvuldiger gekoppel. (2)

6.4 **Gegee:**

R_1 = ?

R_2 = 45

R_3 = 100

R_4 = 10

$R_1 = \frac{R_3 R_2}{R_4} = \frac{100\ x\ 45}{10} = 450\ \Omega$✓✓ (2)

[10]

TOTAAL: 100

Kopiereg voorbehou