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Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T390(A)(J24)T

NASIONALE SERTIFIKAAT

KOMMUNIKASIE-ELEKTRONIKA N5

(8080235)

24 Julie 2018 (X-vraestel)
09:00–12:00

Hierdie vraestel bestaan uit 6 bladsye en 'n formuleblad van 5 bladsye.

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DEPARTEMENT VAN HOËR ONDERWYS EN OPLEIDING
REPUBLIEK VAN SUID-AFRIKA

NASIONALE SERTIFIKAAT
KOMMUNIKASIE-ELEKTRONIKA N5
TYD: 3 UUR
PUNTE: 100

INSTRUKSIES EN INLIGTING

1. Beantwoord AL die vrae.
2. Lees AL die vrae aandagtig deur.
3. Nommer die antwoorde volgens die nommeringstelsel wat in hierdie vraestel gebruik word.
4. Skryf netjies en leesbaar.

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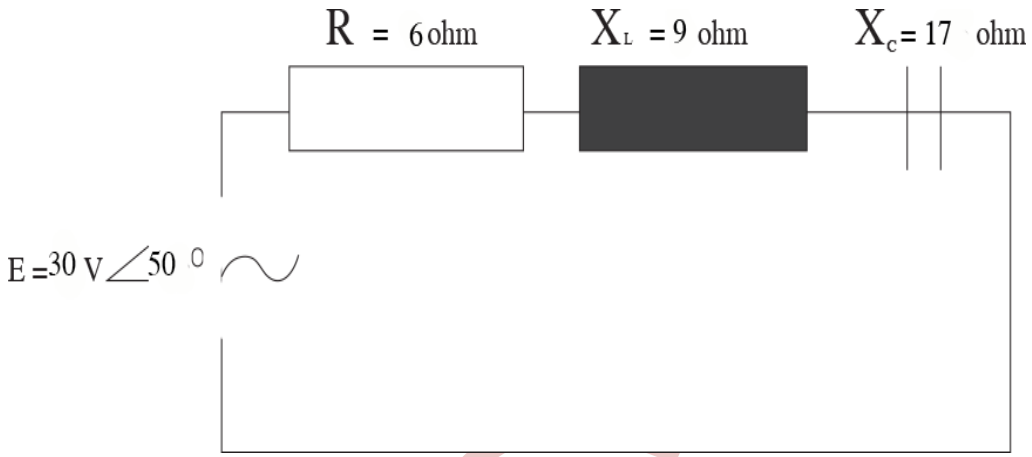
VRAAG 1: WS-NETWERKE



FIGUUR 1

Raadpleeg FIGUUR 1 en bereken die volgende hoeveelhede:

1.1	I_T	(3)
1.2	VR	(2)
1.3.	VL	(2)
1.4	VR2/R	(2)
1.5	P_T	(2)
1.6	Θ en EI Cos θ	(4)
1.7	I^2R	(2)
1.8	ER	(2)
1.9	I^2Z	(2)
1.10	E^2/Z	(3)

[24]

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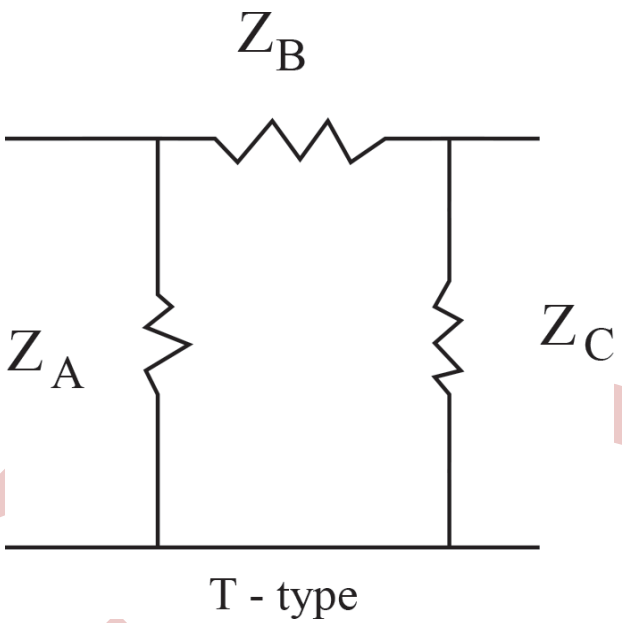
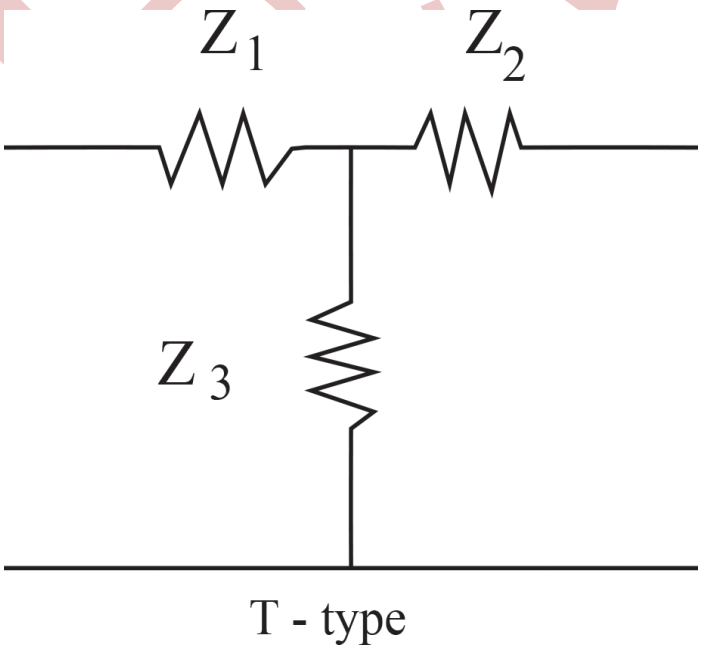
VRAAG 2: VIERAANSLUITERNETTE

2.1 Definieer invoegingsverlies van 'n vieraansluiternet. (2)

2.2 Ontwikkel uitdrukkings vir transformasie van 'n π-net (FIGUUR 2) na 'n T-net (FIGUUR 3) en vind alle waardes van die ekwivalente T-verbinding met ZA, ZB en ZC wat waardes het van onderskeidelik 367 Ω, 1 486 Ω en 367 Ω.



FIGUUR 2



FIGUUR 3

(18)
[20]

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VRAAG 3: FILTERS

3.1 Beskryf in konstante k-filter in detail. (4)

3.2 Definieer 'n filter. (2)

3.3 Bepaal die afsnyfrekwensie van 'n prototipe wat oor die volgende beskik:

$\frac{C}{2}$ = 1 µF
L = 1 000 mH (4)

3.4 Benoem die soort filter wat u in VRAAG 3.3 vasgestel het. (2)

3.5 Dui aan of die volgende stelling WAAR of ONWAAR is. Kies die antwoord en skryf in die ANTWOORDBOEK slegs 'Waar' of 'Onwaar' langs die vraagnommer (1.3.1-1.3.10) neer.

Sommige LC-filters gebruik weerstand. (1)
[13]

VRAAG 4: ONTVANGERS EN SENDERS

4.1 Noem DRIE komponente wat die draaggolf bevat. (3)

4.2 Beeld met eenvoudige sketse die frekwensiespektrum uit van die RF-sein vanaf 'n AM-sender as elk van die volgende gesend word:

4.2.1 Die RF-draer en al twee sybande (3)

4.2.2 Slegs die bosyband (1)

4.2.3 Die bo- en ondersyband sonder die draer (2)

4.2.4 Slegs die RF-draer (1)

4.2.5 Slegs die ondersyband (1)

4.3 Teken 'n volledig benoemde kringdiagram waarmee 'n frekwensiegemoduleerde draer wat die moduleersein verlaat, verdryf word. (16)

4.4 Benoem die kring in VRAAG 4.3. (1)
[28]

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VRAAG 5: ANTENNAS

Beskryf elk van die volgende terme:

5.1 Bundelbreedte

5.2 Antenna

5.3 Resonansieantenna

5.4 Effektiewe stralingsvlak

5.5 Dipoolantenna

(5 × 3) **[15]**

TOTAAL: 100

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FORMULEBLAD

Enige toepslike formule kan ook gebruik word.

Induktiewe reaktansie

$$X_L = 2\pi\ fL$$

Kapasitiewe reaktansie

$$X_c = \frac{1}{2\pi\ fC}$$

Serieformules

$$Z_T = \sqrt{R^2 + (X_L - X_c)^2}$$

$$\tan\theta = \frac{X_L - X_C}{R}$$

$$BW = \frac{f_o}{Q} = \frac{R}{2\pi\ L}$$

$$p.f = Cos\phi$$

$$P = VICos\phi$$

$$Y = \frac{1}{Z} = G \pm jB$$

Parallelformules

$$I_T = \sqrt{I_R^2 + (I_C - I_L)^2}$$

$$\tan\theta = \frac{I_C - I_L}{I_R}$$

$$I_X = I_C - I_L$$

$$p.f = Cos\phi$$

$$P = VICos\phi$$

$$Y_T = Y_1 + Y_2$$

Serieresonansie

$$f_r = \frac{1}{2\pi\ \sqrt{LC}}$$

$$Z = R$$

$$\phi = 0°$$

$$p.f = Cos\phi = 1$$

$$Q = \frac{X_L}{R} = \frac{X_C}{R} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

$$BW = \frac{f_o}{Q} = \frac{R}{2\pi\ L}$$

Parallelresonansie

$$f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$$

$$Z_D = \frac{L}{RC}$$

$$\phi = 0°$$

$$p.f = Cos\phi = 1$$

$$Q = \frac{X_L}{R} = \frac{X_C}{R} = \frac{1}{R}\sqrt{\frac{L}{C}}$$

$$BW = \frac{f_o}{Q} = \frac{R}{2\pi\ L}$$

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FILTERS:

Onderdeurlaatfilter

$$R_o = \sqrt{\frac{L}{C}}$$

$$f_c = \frac{1}{\pi\sqrt{LC}}$$

$$C = \frac{1}{\pi\ R_o\ f_c}$$

$$L = \frac{R_o}{\pi\ f_c}$$

$$Z_{OT} = \sqrt{\frac{L}{C}} \times \sqrt{1 - \frac{\omega^2 LC}{4}}$$

$$Z_{o\pi} = \frac{R_o}{\sqrt{1 - \frac{\omega^2 LC}{4}}}$$

Bodeurlaatfilter

$$R_o = \sqrt{\frac{L}{C}}$$

$$f_c = \frac{1}{4\pi\sqrt{LC}}$$

$$C = \frac{1}{4\pi\ R_o\ f_c}$$

$$L = \frac{R_o}{4\pi\ f_c}$$

$$Z_{OT} = \sqrt{\frac{L}{C}} \times \sqrt{1 - \frac{1}{4\omega^2 LC}}$$

$$Z_{o\pi} = \frac{R_o}{\sqrt{1 - \frac{1}{4\omega^2 LC}}}$$

SIMMETRIESE VIERAANSLUITERNETTE

T-Net

$$Z_{in} = Z_{out/uit}$$

$$Z_{OT} = \sqrt{Z_{oc} Z_{sc}}$$

$$Z_{OT} = \sqrt{\frac{Z_1^{\ 2}}{4} + Z_1 Z_2} = \frac{Z_1 Z_2}{Z_{O\pi}}$$

$$Z_1 = 2\left[Z_{oc} - \sqrt{Z_{oc}(Z_{oc} - Z_{sc})}\right]$$

$$Z_2 = \sqrt{Z_{oc}(Z_{oc} - Z_{sc})}$$

π -Net

$$Z_{in} = Z_{out/uit}$$

$$Z_{O\pi} = \sqrt{Z_{oc} Z_{sc}}$$

$$Z_{O\pi} = \frac{Z_1 Z_2}{\sqrt{\frac{Z_1^{\ 2}}{4} + Z_1 Z_2}} = \frac{Z_1 Z_2}{Z_{OT}}$$

$$Z_1 = \frac{Z_{sc}\left[Z_{oc} \pm \sqrt{Z_{oc}\ (Z_{oc} - Z_{sc})}\right]}{Z_{oc} + \sqrt{Z_{oc}(Z_{oc} - Z_{sc})} - Z_{sc}}$$

$$Z_2 = \frac{1}{2}\left[Z_{oc} \pm \sqrt{Z_{oc}(Z_{oc} - Z_{sc})}\right]$$

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ASIMMETRIESE VIERAANSLUITERNETTE:

L-seksie-spieëlbeeldimpedansie

$$Z_{o_1} = \sqrt{Z_1^2 + Z_1 Z_2}$$

$$Z_{o_2} = \frac{Z_1 Z_2}{\sqrt{Z_1^2 + Z_1 Z_2}}$$

L-seksie-herhaalimpedansie

$$Z'O_1 = \sqrt{\frac{Z_1^2}{4} + Z_1 Z_2} + \frac{Z_1}{2}$$

$$Z'O_2 = \sqrt{\frac{Z_1^2}{4} + Z_1 Z_2} - \frac{Z_1}{2}$$

NETOMSETTINGS:

T omsetting→ π

$$ZA = \frac{Z_1 Z_2 + Z_2 Z_3 + Z_1 Z_3}{Z_2}$$

$$ZB = \frac{Z_1 Z_2 + Z_2 Z_3 + Z_1 Z_3}{Z_3}$$

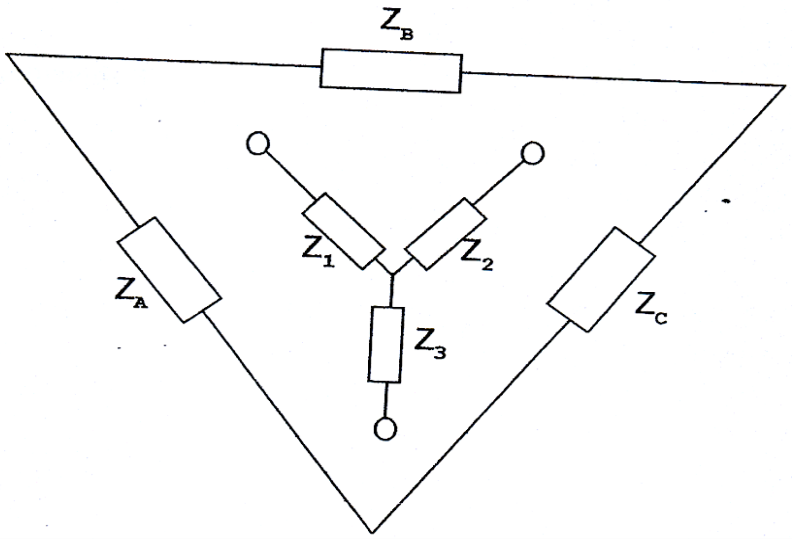
$$ZC = \frac{Z_1 Z_2 + Z_2 Z_3 + Z_1 Z_3}{Z_1}$$

π →T-omsetting

$$Z_1 = \frac{Z_A Z_B}{Z_A + Z_B + Z_C}$$

$$Z_2 = \frac{Z_B Z_C}{Z_A + Z_B + Z_C}$$

$$Z_3 = \frac{Z_A \,.\, Z_C}{Z_A + Z_B + Z_C}$$



VERSWAKKERS IN DIE ALGEMEEN:

dB = 8,686 × Neper

$$dB = 10 \log \left(\frac{P_{in}}{P_{uit/uit}} \right)$$

$dB = 20 \log N$

$$\text{Insertion loss} = 10 \log \frac{P_1}{P_2} = 20 \log \frac{I_1}{I_2}$$

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Simmetriese verswakkers

$$N = \frac{I_{in}}{I_{out/uit}} = \sqrt{\frac{P_{in}}{P_{out/uit}}}$$

Asimmetriese verswakkers

$$N = \sqrt{\frac{P_{in}}{P_{out/uit}}}$$

T-tipe

$$R_a = \frac{R\,(N-1)}{N+1}$$

$$R_b = \frac{2RN}{N^2-1}$$

L-tipe

$$R_a = \sqrt{R_1(R_1 - R_2)}$$

$$R_b = \sqrt{\frac{R_1 R_2^2}{R_1 - R_2}}$$

π-tipe

$$R_a = \frac{R\,(N+1)}{N-1}$$

$$R_b = \frac{R(N^2-1)}{2N}$$

Oorbrugde T

$$R_a = R = Z_o$$

$$R_b = R\,(N-1)$$

$$R_c = \frac{R}{N-1}$$

WEDERSYDSE INDUKTANSIE

$$M = \sqrt{L_p \times L_s} \times k$$

$$k = \frac{M}{\sqrt{L_p P_s}}$$

$$k_c = \frac{1}{\sqrt{Q_p Q_s}}$$

$$Z_c = \frac{(\omega M)^2}{Z_s}$$

$$f_1 = \frac{f_o}{\sqrt{1+k}}$$

$$f_2 = \frac{f_o}{\sqrt{1-k}}$$

$$Q_p = \frac{X_{LP}}{R_p}$$

$$Q_s = \frac{X_{LS}}{R_s}$$

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Puntreël

$$L_T = L_1 + L_2 + 2M$$
$$L_T = L_1 + L_2 - 2M$$

AM

$$m = \frac{V_m}{V_c} \qquad P_{DSB} = \frac{m^2 Pc}{2}$$

$$P_T = P_c\left(1 + \frac{m^2}{2}\right) \qquad m_T = \sqrt{m_1^2 + m_2^2}$$

$$v_c = V_C Sin\,\omega_C t + \frac{mV_C}{2}\cos(\omega_C - \omega_m)t - \frac{mV_C}{2}\cos(\omega_C + \omega m_m)t$$

FM

$$v_c = V_c \sin(\omega_{\cos} t - m\cos\omega_M t)$$

$BW = f_{\text{mod}}$ x (aantal sybande) x 2

Shannon-Hartley

$$C = \Delta f \log_2\left(1 + \frac{S}{N}\right) \qquad dB = 10\log\left(\frac{\text{signal power}}{\text{noise power}}\right)$$

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