



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

SEPTEMBER 2010

ELECTRICAL TECHNOLOGY

MARKS: 200

TIME: 3 hours



This question paper consists of 12 pages.

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Sketches and diagrams must be large, neat and fully labelled.
3. All calculations must be shown, and correct to two decimal places.
4. Answers must be clearly numbered.
5. A formula sheet is provided at the end of the paper.
6. Non-programmable calculators may be used.

QUESTION 1 TECHNOLOGY, SOCIETY AND THE ENVIRONMENT

- 1.1 Technological advancement has an influence on different cultures. Mention TWO examples where Electrical Technology has influenced your culture. (2)
- 1.2 Technological skills development is important for economic growth. State THREE competencies that are required of a successful entrepreneur. (3)
- 1.3 Mention ONE manner in which disease could be spread at the workplace. (1)
- 1.4 Mention TWO negative impacts that Electrical Technology has on the environment and give an example of each. (4)

[10]**QUESTION 2 THE TECHNOLOGICAL PROCESS**

- 2.1 Your loving pet, a small fox terrier dog, was involved in an accident and the veterinary surgeon removed both its back legs. The dog cannot walk anymore and you are desperate to try and help the dog by designing a device to be strapped on so that the dog can move around using its front legs only. The device must use an electrical motor that will switch on when movement starts enabling the dog to move easily.
- 2.1.1 Name THREE specifications for the designed finished product that would solve the problem as stated above. (3)
- 2.1.2 Describe TWO methods of collecting data enabling you to understand and solve the design problem better. (2)
- 2.1.3 List TWO appropriate technological processes you can use to present and communicate your design effectively. (2)
- 2.1.4 When designing and building an artefact, what significant role does evaluating the solution have? (3)

[10]

QUESTION 3 OCCUPATIONAL HEALTH AND SAFETY ACT

- 3.1 Which THREE elements must be present for a fire to start? (3)
- 3.2 Name TWO precautions that one should take into account when using a multimeter. (2)
- 3.3 Explain what safety precautions you would institute in your workshop to prevent the spread of HIV/Aids. (2)
- 3.4 State ONE unsafe act that could take place in an electrical technology workshop. (1)
- 3.5 State ONE unsafe condition that could exist in an electrical technology workshop. (1)
- 3.6 Describe ONE good internal housekeeping rule. (1)

[10]**QUESTION 4 THREE PHASE AC GENERATION**

- 4.1 Give TWO advantages of three phase generation over that of single phase generation. (2)
- 4.2 A three-phase delta connected motor draws 25 A from a 380 V supply at a factor of 0,86 lagging. Given $I_L = 25 \text{ A}$, $V_L = 380 \text{ V}$ and $\cos \phi = -0,86$, calculate:
- 4.2.1 The input power (3)
- 4.2.2 The apparent power (3)
- 4.3 The wattmeter consists of two coils. Briefly explain how these coils would be connected to the load and the supply. (2)

[10]

QUESTION 5 PRINCIPLES ON AC ON RLC COMPONENTS

- 5.1 A series circuit consists of a resistor of 25 ohms, an inductor of 0,3 henry and a 160 microfarad capacitor. The circuit is connected across a 150 V, 100 Hz supply. Given: $R = 25 \Omega$, $L = 0,3 \text{ H}$, $C = 160 \mu\text{F}$, $V = 150 \text{ V}$ and $f = 100 \text{ Hz}$.

Calculate the following:

- 5.1.1 Inductive Reactance (3)
- 5.1.2 Capacitive Resistance (3)
- 5.1.3 Impedance (3)
- 5.1.4 Current flow (3)
- 5.1.5 Phase angle (3)
- 5.1.6 Resonant Frequency (3)

5.2

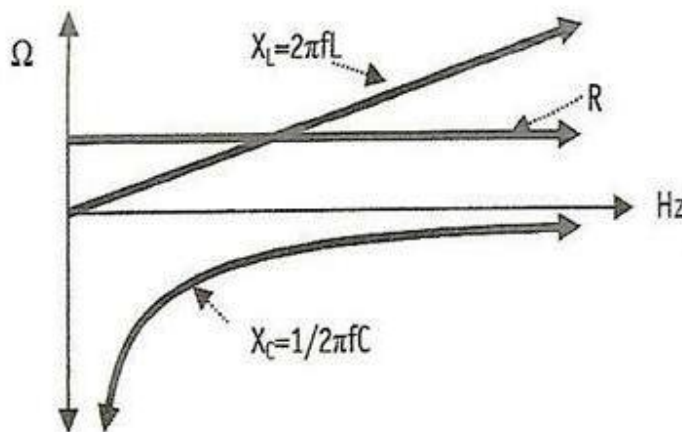


Figure 5.2 Reactance of R, L and C versus frequency

Study the figure above and state what effect frequency has on the following:

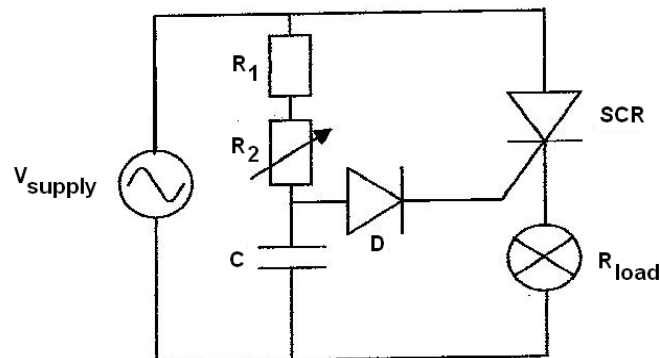
- 5.2.1 Resistance (2)
- 5.2.2 Inductive reactance (2)
- 5.3 Explain, with reference to X_L and X_C how you can determine if a series RLC circuit is INDUCTIVE or CAPACITIVE. (2)

- 5.4 Read the following statements and state if it is TRUE/FALSE. Write only the letter next to the number. (For example 5.4.7 T)
- 5.4.1 A series RLC circuit can have a higher voltage than the source voltage across the resistor. (1)
- 5.4.2 The impedance of a series RLC circuit is dependent on the source voltage. (1)
- 5.4.3 The total reactance of a series RLC circuit at resonance is zero. (1)
- 5.4.4 At frequencies below resonance in a parallel RLC circuit, the current lags the source voltage. (1)
- 5.4.5 The resonant frequency of a parallel circuit is the same as a series circuit using the same components when Q is very low. (1)
- 5.4.6 In a parallel RLC circuit, the total impedance is always greater than the resistance. (1)

[30]**QUESTION 6 SWITCHING AND CONTROL**

- 6.1 There are four major devices in high-power rectification; two of those are the SCR and the TRIAC. State how the TRIAC differs from the SCR. (4)
- 6.2 Explain briefly how the DIAC operates. (4)
- 6.3 Draw fully labelled symbols for the following:
- 6.3.1 DIAC (2)
- 6.3.2 TRIAC (3)

6.4 Study the following figure and answer the questions that follow.



6.4.1 Answer TRUE/FALSE:

This circuit is a TRIAC light-dimming circuit with a trigger circuit to adjust the firing angle. (1)

6.4.2 Fill in the missing words:

The angle from the start of a cycle to the point of triggering is called the ... and the angle during which the SCR is on is called the ... (2)

6.4.3 Mention the process of controlling the voltage across the load (1)

6.4.4 Mention the function of the RC circuit. (3)

6.4.5 State the effect of R_1 in the circuit. (2)

6.4.6 State the effect of R_2 in the circuit. (3)

[25]

QUESTION 7 OPERATIONAL AMPLIFIERS

7.1 Various options are provided as possible answers to the following questions. Choose the correct answer and write the letter (A – D) next to the question number. For example (7.1.6 B)

7.1.1 The purpose of a comparator is to:

- A amplify an input voltage.
- B detect the occurrence of a changing input voltage.
- C produce a change in output when an input voltage equals a reference voltage.
- D maintain a constant output when the dc input voltage changes. (1)

7.1.2 To use a comparator for zero-level detection, the inverting is connected to:

- A The ground
- B The dc supply voltage
- C A positive reference voltage
- D A negative reference voltage (1)

7.1.3 The feedback path in an ideal OP-AMP integrator consists of a:

- A Resistor
- B Capacitor
- C Resistor and a capacitor in series
- D Resonant circuit (1)

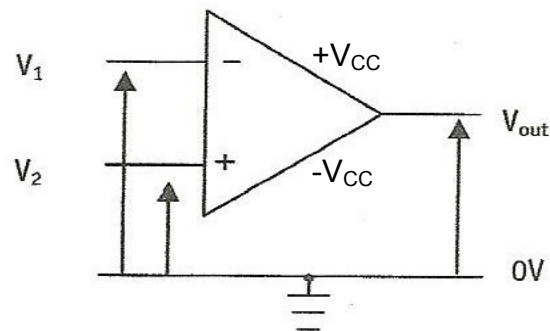
7.1.4 The feedback path in an OP-AMP differentiator consists of a:

- A Resistor
- B Capacitor
- C Resistor and a capacitor in series
- D Resistor and a capacitor in parallel (1)

7.1.5 The OP-AMP comparator circuit uses:

- A Positive feedback
- B Negative feedback
- C Regenerative feedback
- D No feedback (1)

7.2



Determine the output voltage of the OP-AMP in the figure above for the following conditions:

- 7.2.1 If $V_1 > V_2$ (1)
- 7.2.2 If $V_1 < V_2$ (1)
- 7.2.3 If $V_1 = V_2$ (1)
- 7.3 State THREE characteristics of an ideal OP-AMP. (3)
- 7.4 Mention THREE practical applications in which transistors are used. (3)
- 7.5 Why is it necessary for an OP-AMP to be supplied with both a positive and a negative power supply? (2)
- 7.6 What is the difference between the inverting and the non-inverting inputs of an OP-AMP? (4)
- 7.7 Name TWO advantages of negative feedback in OP-AMPS. (2)
- 7.8 State THREE advantages of negative feedback with reference to amplifiers. (3)

[25]

QUESTION 8 THREE-PHASE TRANSFORMERS

- 8.1 A three-phase transformer with 3 500 turns on the primary is connected in delta-star to a supply voltage of 4 000 V. The full load line current on the primary is 20 A when the secondary line voltage is 380 V and the power factor is 0,9:
- 8.1.1 The secondary phase voltage (3)
- 8.1.2 The turns ratio (3)
- 8.2 There are various methods of connecting the primary and secondary windings of Three-phase transformers. State THREE. (3)
- 8.3 Mention THREE losses that occur in transformers. (3)
- 8.4 State TWO disadvantages of autotransformers. (2)
- 8.5 Overheating in transformers can be prevented by using various methods, mention ONE of these methods. (1)
- [15]**

QUESTION 9 LOGIC CONCEPTS AND PLCs

- 9.1 The PLC is CHEAPER and ECONOMICAL for a control panel with more than ten relays. This is one of the advantages of the PLC. Mention THREE more advantages of PLCs. (3)
- 9.2 There are basically THREE types of programming languages used for PLC programming. Name these THREE languages. (3)
- 9.3 Write down the question number and draw the corresponding symbol of:

Circuit Diagram Symbol	Description	Ladder Diagram Symbol
9.3.1	Normally open switch or other type of normally open device used as input to the PLC	9.3.4
9.3.2	Normally close switch or other type of normally close device used as input to the PLC	9.3.5
9.3.3	Relay or other type of device used as output from a PLC	9.3.6

(6)

- 9.4 Develop a truth table for this Boolean expression:

$$\text{Output} = \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC \quad (4)$$

- 9.5 Using Boolean algebra techniques simplify the expression in QUESTION 9.4. (7)

- 9.6 With reference to the truth table for the Boolean expression in QUESTION 9.4 above, draw the following:

- 9.6.1 The logic gate network that would represent the simplified Boolean expression in QUESTION 9.5. (8)

- 9.7 Sequential logic systems are combination systems with some of the outputs fed back as inputs. The simplest sequential system is multivibrators (flip-flop). Mention TWO types of multivibrators. (2)

- 9.8 Mention ONE key characteristic of each of the multivibrators in QUESTION 9.7. (2)

[35]

QUESTION 10 THREE PHASE MOTORS AND CONTROL

- 10.1 Name THREE tests that must be performed on the windings of a new electric motor before its put into operation. (3)

- 10.2 Mention the TWO factors which determine the speed of an induction type alternating current motor. (2)

- 10.3 Explain how the direction of a rotation can be changed in a three-phase motor. (1)

- 10.4 Briefly explain the operation of an induction motor. (8)

- 10.5 Mention FOUR examples of safety devices that could be included in the safety circuit of a motor starter. (4)

- 10.6 What is the purpose of the no-volt coil in a motor starter? (2)

- 10.7 Briefly explain the star-delta starting process. (6)

- 10.8 Electrical motors have internal losses which can be categorized into three types. Mention TWO of these categories. (2)

- 10.9 Why is star-delta starters used to start three-phase motors? (2)

[30]

TOTAL: 200

ELECTRICAL TECHNOLOGY

FORMULA SHEET

$$Z = \sqrt{R^2 + (X_L \approx X_C)^2}$$

$$V_r = I_t \times R$$

$$I_t = V_t / Z$$

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

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

$$V_L = I_t \times X_L$$

$$V_C = I_t \times X_C$$

$$I_t = \sqrt{I_r^2 + (I_C \approx I_L)^2}$$

$$I_r = V_r / R$$

$$I_L = V_C / X_L$$

$$I_C = V_C / X_C$$

$$\cos \phi = I_r / I_t$$

$$X_L = 2\pi f L$$

$$X_C = 1 / 2\pi f C$$

$$P = V \times I \times \cos \phi$$

$$\cos \phi = R / Z$$

$$\tan \phi = X_L - X_C / R$$

$$\cos \phi = P / VA$$

$$P = I^2 R$$

$$I_{act} = I \times \cos \phi$$

$$I_{react} = I \times \sin \phi$$

Star

Delta

$$I_L = I_{ph}$$

$$I_L = \sqrt{3} \times I_{ph}$$

$$V_L = \sqrt{3} \times V_{ph}$$

$$V_L = V_{ph}$$

$$F = P_n / 60$$

$$P = \sqrt{3} V_L \times I_L \times \cos \phi$$

$$S = \sqrt{3} \times V_L \times I_L \quad V_P / V_S = N_P / N_S = I_S / I_P \quad \text{or/of} \quad V_1 / V_2 = N_1 / N_2 = I_2 / I_1$$

$$\text{Efficiency} = \text{Output} / \text{Input}$$

ELEKTRIEISE TECHNOLOGIE

FORMULEBLAD

$$Z = \sqrt{R^2 + (X_L \approx X_C)^2}$$

$$V_r = I_t \times R \quad I_t = V_t / Z$$

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

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

$$V_I = I_t \times X_L$$

$$V_C = I_t \times X_C$$

$$I_t = \sqrt{I_r^2 + (I_C \approx I_L)^2} \quad I_r = V_r / R \quad I_L = V_C / X_L \quad I_C = V_C / X_C \quad \cos \emptyset = I_r / I_t$$

$$X_L = 2\pi f L \quad X_C = 1 / 2\pi f C$$

$$P = V \times I \times \cos \emptyset \quad \cos \emptyset = R / Z \quad \tan \emptyset = X_L - X_C / R \quad \cos \emptyset = P / V_A$$

$$P = I^2 R$$

$$I_{act} = I \times \cos \emptyset$$

$$I_{react} = I \times \sin \emptyset$$

Ster

$$I_L = I_{ph}$$

$$I_L = \sqrt{3} \times I_{ph}$$

$$V_I = \sqrt{3} \times V_{ph}$$

$$V_I = V_{ph}$$

$$F = P_n / 60$$

$$P = \sqrt{3} \times V_I \times I_L \times \cos \emptyset$$

$$S = \sqrt{3} \times V_I \times I_L \quad V_P / V_S = N_P / N_S = I_S / I_P \quad \text{or / of} \quad V_1 / V_2 = N_1 / N_2 = I_2 / I_1$$

$$\text{Effektiviteit} = U_{itset} / I_{nset}$$

9.4	Ontwikkel 'n waarheidstabel vir die volgende Boolese uitdrukking:	(4)
9.5	Deur Boolese Algebra te gebruik, vereenvoudig die uitdrukking in VRAAG 9.4.	(7)
9.6	Met verwysing na die waarheidstabel vir die Boolese uitdrukking in VRAAG 9.4 hierbo, teken die volgende:	
9.6.1	Die logiese hek-netwerk wat die vereenvoudigde Boolese uitdrukking in VRAAG 9.5 verteenwoordig.	(8)
9.7	Opeenvolgende logiese sisteme is kombinasie sisteme met sommige van die uitsette wat teruggevoer word as insette. Die eenvoudigste opeenvolgende sisteem is multi-vibrators (flip-flop). Meld TWEE soorte multivibrators.	(2)
9.8	Noem EEN kenmerkende eienskap vir elk van die multivibrators in VRAAG 9.7.	(3)
VRAAG 10 DRIE-FASE MOTORS EN BEHEER		
10.1	Noem DRIE toetse wat uit gevoer moet word op die windings van 'n nuwe elektriese motor voordat dit in werking gestel word.	(3)
10.2	Noem TWEE faktore wat die spoed van 'n induksie tipe wisselstroom motor bepaal.	(2)
10.3	Verduidelik hoe die rigting van rotasie in 'n drie-fase motor verander kan word.	(1)
10.4	Verduidelik kortliks die werking van 'n induksie-motor.	(8)
10.5	Noem VIER voorbeelde van veiligheids toestelle wat ingesluit kan word in die veiligheidskring van 'n motor se aansluitkring.	(4)
10.6	Wat is die doel van die nul-las spoel in 'n motor se aansluitkring?	(2)
10.7	Verduidelik kortliks die werking van die ster-delta aansluitproses.	(6)
10.8	Elektriese motors besit interne verliese, wat in drie tipe kategorieë geplaas kan word. Noem TWEE van hierdie kategorieë.	(2)
10.9	Waarom word ster-delta aanslitters gebruik om drie-fase motors aan te skakel?	(2)
TOTAAL: 200		
[30]		

VRAAG 8 DRIE-FASE TRANSFORMATORS

- 8.1 In Drie-fase transformator met 3 500 draie op die primêre spoel is verbind in delta-ster aan 'n voorsiening van 4 000 V. Die volles lynstroom op die primêr is 20 A as die sekondêre lyn spanning 380 V en die arbeidsfaktor 0,9 is:

Bereken:

- 8.1.1 Die sekondêre fase-spanning (3)
- 8.1.2 Die windingsverhouding (3)

- 8.2 Daar is verskeie metodes van koppeling by die primêre en sekondêre windings van 'n drie-fase transformator. Noem TWEE. (2)

- 8.3 Noem DRIE tipes van verliese wat by transformators voorkom. (3)

- 8.4 Noem TWEE nadele van outo-transformators. (2)

- 8.5 Oorverhitting by transformators kan op verskeie wyses voorkom word. Noem EEN van hierdie metodes. (1)

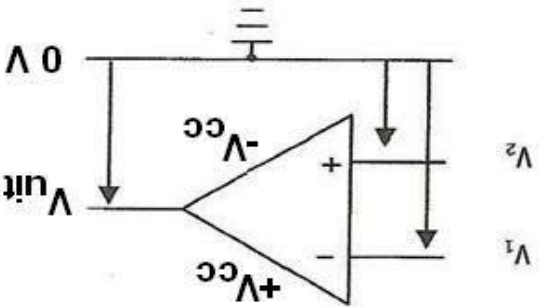
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VRAAG 9 LOGIKA KONSEPTE EN PLC's

- 9.1 Die PLC is GOEDKOPPER en meer EKONOMIES vir 'n paneel met meer as tien relê's. Dit is een van die voordele van 'n PLC. Noem nog DRIE meer voordele. (3)
- 9.2 Daar bestaan basies drie tipes programmeertale vir die programmering van PLC. Noem die DRIE tale. (3)
- 9.3 Skryf die vraagnummer neer en teken die ooreenstemmende simbool van: (6)

Kringdiagram simbool	Beskrywing	Leërdiagram-simbool
9.3.1	Normaal oop skakelaar of ander tipe normaal oop apparaat wat gebruik word as inset by die PLC	9.3.4
9.3.2	Normaal geslote skakelaar of ander tipe normaal geslote apparaat wat gebruik word as inset by die PLC	9.3.5
9.3.3	Relê of ander tipe apparaat wat gebruik word as uitset by die PLC	9.3.6

7.2



Bepaal die uitset spanning van die OP-VERSTERKER in die figuur hierbo vir die volgende toestande:

- 7.2.1 As $V_1 > V_2$ (1)
- 7.2.2 As $V_1 < V_2$ (1)
- 7.2.3 As $V_1 = V_2$ (1)

7.3 Gee DRIE eienskappe van 'n ideale OP-VERSTERKER. (3)

7.4 Noem DRIE praktiese toepassings waarin transistors gebruik word. (3)

7.5 Waarom moet 'n OP-VERSTERKER voorsien word van 'n positiewe- en negatiewe kragvoorsiening? (2)

7.6 Wat is die verskil tussen die omgekeerde- en nie-omgekeerde insette van 'n OP-VERSTERKER? (4)

7.7 Noem TWEE voordele van negatiewe terugvoer by OP-VERSTERKERS. (2)

7.8 Meld DRIE voordele van negatiewe terugvoer met verwysing na versterkers. (3)

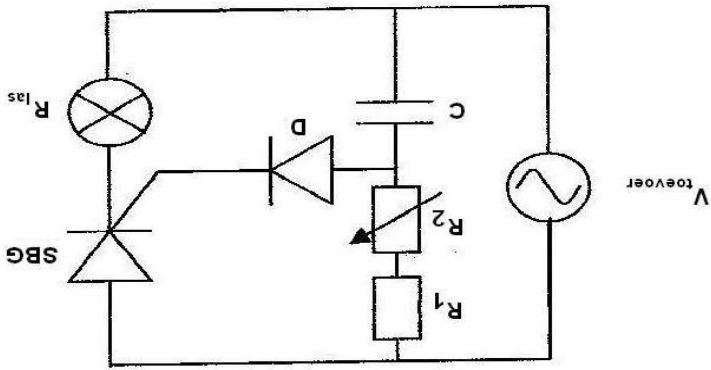
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VRAAG 7 OPERASIONELE VERSTERKERS

7.1 Verskeie moontlike antwoorde word vir die volgende vrae gegee. Kies die korrekte antwoord en skryf slegs die letters (A – D) teenoor die vraagnommer, byvoorbeeld (7.1.6 B)

- 7.1.1 Die doel van 'n vergelyker is om:
- A insetspanning te versterk.
 B die teenwoordigheid van 'n veranderende inset spanning waar te neem.
 C 'n verandering in uitset te verskat wanneer die insetspanning gelyk is aan die verwysingspanning.
 D 'n konstante uitset te verseker wanneer die gelykstrom-insetspanning verander.
- (1)
- 7.1.2 Om die vergelyker te gebruik as nul vlak waarnemer, word die omkeer verbind aan:
- A Die grond
 B Die gs-voorsiening spanning
 C 'n Positiewe verwysingspanning
 D 'n Negatiewe verwysingspanning
- (1)
- 7.1.3 Die terugvoer in 'n ideale OP-VERSTERKER integreerder bestaan uit:
- A Resistor
 B Kapasitor
 C Resistor en kapasitor in serie
 D Resonante-kring
- (1)
- 7.1.4 Die terugvoer in 'n OP-VERSTERKER as differensieerder bestaan uit:
- A Resistor
 B Kapasitor
 C Resistor en kapasitor in serie
 D Resistor en kapasitor in parallel
- (1)
- 7.1.5 Die OP-VERSTERKER as vergelykerkring gebruik:
- A Positiewe terugvoer
 B Negatiewe terugvoer
 C Regenerereerbare terugvoer
 D Geen terugvoer
- (1)

6.4 Bestudeer die volgende diagram en beantwoord die vrae wat volg:



6.4.1 Antwoord WAAR/VALS:

Die kring is 'n TRIAK ligverdwingskring, met 'n snellerkring om die aansithoek te verstel.

6.4.2 Volttooi die sin deur die ontbrekende woorde in te vul:

Die hoek van die begin van die siklus tot by die punt van snellering, word die ... genoem, en die hoek waartydens die SBG aan is, word die ... genoem.

6.4.3 Noem die proses wat gebruik word om die spanning oor die las te beheer.

6.4.4 Gee die funksie van die RC-kring.

6.4.5 Noem die doel van R_1 in die kring.

6.4.6 Noem die doel van R_2 in die kring.

[25]

5.4 Lees die volgende stellings en bepaal of hulle WAAR/VALS is. Skryf slegs die letter langs die nommer. (byvoorbeeld 5.4.7 W)

5.4.1 In Serie RLC-kring kan 'n hoër spanning oor die weerstand as die toevoer bron hê. (1)

5.4.2 Die impedansie van 'n serie RLC-kring is afhanklik van die toevoerspanning. (1)

5.4.3 Die totale reaktansie van 'n serie RLC-kring by resonansie is nul. (1)

5.4.4 By frekwensies onder resonansie in 'n parallelle RLC-kring volg die stroom die spanning van die bron. (1)

5.4.5 Die resonante frekwensie van 'n parallelle kring is die selfde as die van 'n serie kring wat dieselfde komponente gebruik as Q baie laag is. (1)

5.4.6 In 'n parallelle RLC-kring sal die totale impedansie altyd groter wees as die weerstand. (1)

VRAAG 6 SKAKEL EN BEHEER [30]

6.1 Daar is vier hoofteestelle wat gebruik word in hoër-spanningsgelykkrigting, waarvan twee die SBG en die TRIAK is. Verduidelik hoe die TRIAK verskil van die SBG. (4)

6.2 Verduidelik kortliks die werking van die DIAK. (4)

6.3 Teken 'n tenvolle benoemde simbool van die volgende:

6.3.1 DIAK (2)

6.3.2 TRIAK (3)

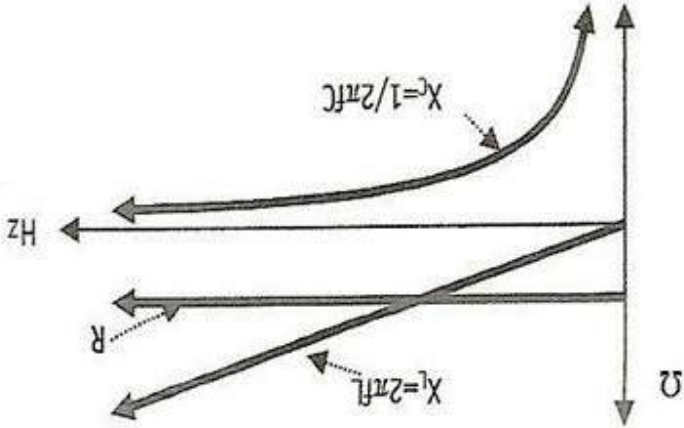
VRAAG 5 BEGINSELS VAN RLC-KRINGE

5.1 In Serie-kring bestaan uit n weerstand van 25 ohms, n induktor van 0,3 henry en n kapasitor van 160 mikrofaraad. Die kring word gekoppel aan n toevoer van 150 V, 100 Hz. Gegee: $R = 25\ \Omega$, $L = 0,3\ \text{H}$, $C = 160\ \mu\text{F}$, $V = 150\ \text{V}$ en $f = 100\ \text{Hz}$.

Bereken die volgende:

- 5.1.1 Induktiewe Reaktansie (3)
- 5.1.2 Kapasitiewe Reaktansie (3)
- 5.1.3 Impedansie (3)
- 5.1.4 Stroomvloei (3)
- 5.1.5 Fasehoek (3)
- 5.1.6 Resonante Frekwensie (3)

5.2



Figuur 5.2 Reaktansie van R, L en C teenoor frekwensie

Bestudeer die bostaande figuur en gee die effek wat frekwensie op die volgende het:

- 5.2.1 Weerstand (2)
- 5.2.2 Induktiewe reaktansie (2)

5.3 Verduidelik, met verwysing na X_L en X_C , hoe jy kan bepaal of n RLC-kring INDUKTIEF of KAPASITIEF is. (2)

VRAAG 3 BEROEPSVEILIGHEID EN GESONDHEIDSWET

- 3.1 Water DRIE elemente moet teenwoordig wees voordat 'n brand kan uitbreek? (3)
- 3.2 Noem TWEЕ voorsorgmaatreëls wat in berekening gebring moet word as jy 'n multimeter gebruik. (2)
- 3.3 Verduidelik watter veiligheidsmaatreëls jy in jou werkswinkel sal instel om te voorkom dat MIV/Vigs sal versprei. (2)
- 3.4 Noem EEN onveilige handeling wat in 'n elektriese tegnologie-werkswinkel kan plaasvind. (1)
- 3.5 Noem EEN onveilige toestand wat in 'n elektriese tegnologie-werkswinkel kan voorkom. (1)
- 3.6 Gee EEN goeie interne huisreël. (1)

[10]**VRAAG 4 DRIEFASE KRAAG-OPWERKING (ws)**

- 4.1 Gee TWEЕ voordele van driefase krag-opwerking bo enkel-fase krag-opwerking. (2)
- 4.2 'n Driefase motor wat in delta gekoppel is trek 25 A vanaf 'n 380 V toevoer met 'n nalopende faktor van 0,86. Gegee $I_L = 25$ A, $V_L = 380$ V en $\cos \phi = -0,86$, bereken: (2)
- 4.2.1 Die insetdrywing (3)
- 4.2.2 Die skyndrywing (3)
- 4.3 Die wattmeter bestaan uit twee spoele. Verduidelik kortliks hoe hierdie spoele aan die las en toevoer gekoppel is. (2)

[10]

VRAAG 1 TEKNOLOGIE, GEMEENSKAP EN OMGEWING

- 1.1 Technologie beïnvloed die vordering van verskillende kulture. Noem TWEE voorbeelde waar Elektriese Technologie jou kultuur beïnvloed. (2)
- 1.2 Technologiese vaardighedsontwikkeling is belangrik vir ekonomiese groei. Gee DRIE eienskappe wat benodig word om 'n suksesvolle entrepreneur te wees. (3)
- 1.3 Noem EEN wyse waarop siektes in die werksplek versprei kan word. (1)
- 1.4 Noem TWEE negatiewe invloede wat Elektriese Technologie op die omgewing het en gee 'n voorbeeld van elk. (4)

[10]**VRAAG 2 DIE TEKNOLOGIESE PROSES**

- 2.1 Jou geliefde troeteldier, 'n klein *fox terrier*-hond, was betrokke in 'n ongeluk en die veearts het albei sy agterbene afgesit. Die hond kan nou nie meer loop nie en jy voel desperaat om hom te probeer help deur 'n apparaat, wat aan hom gekoppel kan word, te ontwerp, sodat hy rond kan beweeg deur slegs sy voorbene te gebruik. Die apparaat moet gebruik maak van aandrywing deur 'n tipe elektriese motor, wat aanskakel sodra beweging waargeneem word en die hond help om makliker te beweeg. (3)
- 2.1.1 Noem DRIE spesifikasies vir die ontwerp van die voltooië produk wat sal voldoen om die probleem hierbo op te los. (3)
- 2.1.2 Beskryf TWEE metodes om inligting te versamel sodat jy die probleem beter kan verstaan en sodoende die ontwerpprobleem makliker kan oplos. (2)
- 2.1.3 Lys TWEE gepaste tegnologiese prosesse wat jy kan gebruik om jou ontwerp aan te bied en effektiëf te kommunikeer. (2)
- 2.1.4 Gedurende die ontwerp en bou van 'n projek, watter belangrike rol speel die evaluasie van die oplossing? (3)

[10]

INSTRUKSIES EN INLIGTING

1. Beantwoord AL die vrae.
2. Sketse en diagramme moet groot, netjies en ten volle benoem wees.
3. Alle berekeninge moet getoon en tot TWEE desimale plekke afgerond word.
4. Antwoorde moet duidelik getoon word.
5. n Formule blad is aan die einde van die vraestel.
6. Nie-programmeerbare sakrekenaars mag gebruik word.



**NASIONALE
SENIOR SERTIFIKAT**

GRAAD 12

SEPTEMBER 2010

ELEKTRIESE TEGNOLOGIE

PUNTE: 200

TYD: 3 uur



Hierdie vraestel bestaan uit 12 bladsye.