Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

SEPTEMBER 2014

ELECTRICAL TECHNOLOGY MEMORANDUM

MARKS: **200**

This memorandum consists of 13 pages.

QUESTION 1: OCCUPATIONAL HEALTH AND SAFETY

1.1 An accident is an unplanned, √ uncontrolled event √ caused by unsafe acts and conditions. √ (3)

1.2 No. √ The employee has the right to privacy. √ (2)

1.3
- Apply direct pressure or use a pressure bandage. √
- Keep the victim calm. √
- Keep the bleeding point above the heart level if possible. √
- When there is arterial bleeding, pressure may be insufficient, and it may be necessary to use a tourniquet. √
- A tourniquet may be used but the tourniquet pressure must be relieved periodically to prevent tissue damage. √ (5)

[10]

QUESTION 2: THREE-PHASE AC GENERATION

2.1 (The question asked for methods used in South Africa.)
- Wind
- Solar
- Hydroelectric
- Pumped storage (Any 2 x 1 √√) (2)

2.2
- Copper losses
- Iron or core losses
- Friction losses
- Windage losses (Any 3 x 1 √√√) (3)

2.3 <u>Generation process</u>
- For three-phase and single phase alternators of similar sizes three-phase will generate more power.
- Three-phase can supply power to single and three-phase loads.
- Three-phase is cheaper to generate.
- Three-phase requires less maintenance.
- Three-phase has two connection options, star and delta. (Any 1 x 2√√)

<u>Transmission and distribution process</u>
- Lower currents mean less heat.
- Less heat means fewer losses.
- Lower current means thinner cables can be used reducing costs.
- Pylons required to support thinner cables will require less metal during construction reducing costs.
- A neutral point is available when connected in star.
- Load distribution and phase balancing becomes possible. (Any 1 x 2 √√)

The load

- Three-phase motors are more efficient.
- Three-phase motors have a higher power factor.
- Three-phase motors have a much higher starting torque.
- Three-phase motors do not need additional starting circuitry.
- For three-phase and single phase motors of similar physical sizes, three-phase will produce more power.
- Three-phase can be connected in star or delta. (Any 1 x 2 √√) (6)

2.4 2.4.1 $V_L = \sqrt{3} \times V_{PH}$ √

$= \sqrt{3} \times 240$ √

$= 415{,}69$ V √ (3)

2.4.2 $S = \sqrt{3} I_L V_L$

$I_L = \frac{S}{\sqrt{3} V_L}$ √

$= \frac{15\,000}{\sqrt{3} \times 415{,}69}$ √

$= 20{,}83$ A √ (3)

2.4.3 $P = \sqrt{3} I_L V_L \cos\theta$ √

$= \sqrt{3} \times 20{,}83 \times 415{,}69 \times 0{,}87$ √

$= 13{,}05$ kW √

OR

$P = S\cos\theta$

$= 15\,000 \times 0{,}87$

$= 13{,}05$ kW (3)

[20]

QUESTION 3: THREE-PHASE TRANSFORMERS

3.1
- Identical turns ratios
- Identical voltage and current ratings
- Identical power ratings
- Identical power factor
- Identical efficiency
- Identical size (Any 3 x 1 √√√) (3)

3.2 3.2.1 $V_{L(SECONDARY)} = V_{L(LOAD)} = 400\ V$

$P = \sqrt{3}\, V_L I_L \cos\theta$

$I_{L(SECONDARY)} = \dfrac{P}{\sqrt{3} V_L \cos\theta}$

$= \dfrac{300\,000}{\sqrt{3} \times 400 \times 0{,}87}$

$= 497{,}72\ A$ (3)

3.2.2 $I_{PH} = \frac{I_{LS}}{\sqrt{3}}$ √

$= \frac{497{,}72}{\sqrt{3}}$ √

$= 287{,}36\ A$ √ (3)

3.2.3 $S = \dfrac{P}{\cos\theta}$

$= \dfrac{300\,000}{0{,}87}$

$= 344{,}83\ kVA$

OR

$S = \sqrt{3} V_L I_L$

$= \sqrt{3 \times 400 \times 497{,}72}$

$= 344{,}83\ kVA$ (3)

3.2.4 $S_{PRIMARY} = S_{SECONDARY} = 344{,}83\ kVA$

$I_L = \dfrac{S}{\sqrt{3} V_L}$

$= \dfrac{344{,}83}{\sqrt{3} \times 6\,000}$

$= 33{,}18\ A$ (3)

3.2.5 $I_{PH} = \frac{I_L}{\sqrt{3}}$

$= \frac{33,18}{\sqrt{3}}$

= 19,16 A (3)

3.3
- Air blast type (or air ventilated type)
- Oil filled self-cooled type
- Oil filled water-cooled type (Any 2 x 1 √√) (2)

[20]

QUESTION 4: THREE-PHASE MOTORS AND STARTERS

4.1
- Rotor √
- Stator √
- Stator windings √

(Also accept end-plates) (3)

4.2
- When the three-phase supply is connected to the motor, a rotating stator field is generated automatically. √
- This rotating stator field induces a large current in the metal rods of the squirrel cage rotor. √
- These induced currents in the rotor create their own magnetic field. √
- The rotating stator field and the rotor magnetic fields react with each other. √
- A force is exerted between the two fields (called torque) and the rotor starts turning in the same direction as the rotating stator field. √
- As the rotor speed increases, less current is induced in the metal rods of the rotor, because the relative speed between the rotating stator field and the rotor decreases as the rotor speed increases. √ (6)

4.3 Swap (change) any two phases √ (1)

4.4 In the event of a power failure the system will switch off, and will not restart until the system is switched on manually by the operator. √√ (2)

4.5 Once the start button is pressed, √ the contactor will energise and the normally open contacts will close, including √ the hold-in contact (in parallel with the start button) providing a current path to the contactor coil. √
The contactor will remain energised until the stop button is pressed, or until the power is removed. √ (4)

4.6
- Continuity/resistance test
- Insulation resistance between windings
- Insulation resistance between windings and earth
- Check for exposed wires
- Check electrical connections in the terminal box (Any 2 x 1 √√) (2)

4.7 4.7.1 $S = \frac{P}{\cos\theta}$

$= \frac{90\,000}{0,85}$

$= 105,88$ kVA (3)

4.7.2 $I_L = \frac{P}{\sqrt{3}V_L \cos\theta}$

$= \frac{90\,000}{\sqrt{3} \times 400 \times 0,85}$

$= 152,83$ A (3)

4.7.3 $\cos\theta = 0,85$

$\theta = \cos^{-1} 0,85$

$= 31,79°$ (3)

4.7.4 $N_S = \frac{60 \times f}{p}$

$= \frac{60 \times 50}{2}$

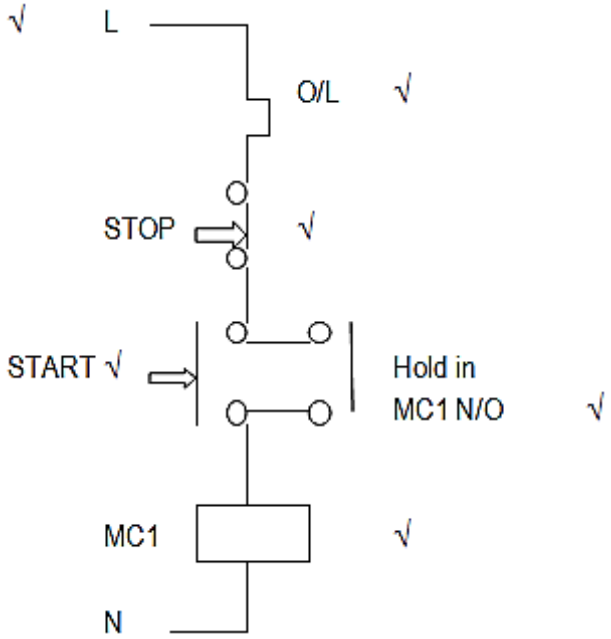
$= 1\,500$ RPM (4)

4.7.5 $\text{Slip} = \frac{N_S - N_R}{N_S} \times 100\%$

$= \frac{1\,500 - 1\,400}{1500} \times 100$

$= 6,67\%$ (3)

4.8



(6)
[40]

QUESTION 5: RCL CIRCUITS

5.1 5.1.1 X_L increases (1)

5.1.2 X_C decreases (1)

5.2 $X_L = X_C$
Z is at minimum
Z = R
I is at maximum
cos θ = 1
θ = 0^o (Any 2 x 1 √√) (2)

5.3 5.3.1 $I_R = \frac{V_S}{R} = \frac{100}{50} = 2$ A (3)

5.3.2 $I_L = \frac{V_S}{X_L} = \frac{100}{31,42} = 3,183$ A (3)

5.3.3 $I_C - I_L = \sqrt{I_T^2 - I_R^2}$

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

$= \sqrt{4,6^2 - 2^2} + 3,183$

= 7,325 A (4)

5.3.4 $\frac{1}{2\pi fc} = \frac{V_S}{I_C}$ √

$X_C = \frac{100}{7{,}325}$ √ $= 13{,}65\ \Omega$ √

$C = \frac{1}{2\pi f X c}$ √

$c = \frac{1}{2\pi \times 50 \times 13{,}65}$

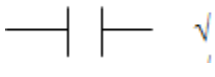
$= 233\ \mu F$ √ (6)

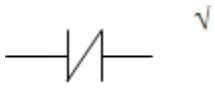
[20]

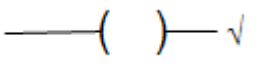
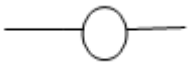
QUESTION 6: LOGIC

6.1
- Power Supply √
- Input/Output devices√
- Processor √
- Programming device √ (4)

6.2

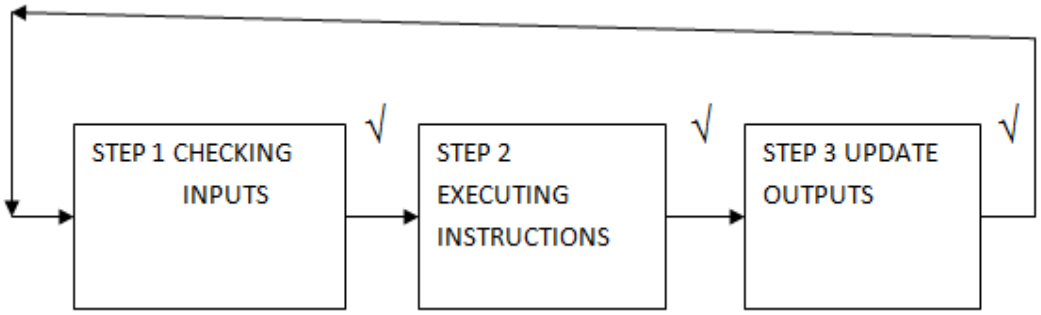

√ normally open contact √


√ normally closed contact √


√ or  output √ (6)

6.3
- Very compact solid state device that is relatively small
- Uses about 10% of the amount of energy of a relay system
- Long life and less maintenance
- Less expensive/Economical
- No moving parts, therefore more reliable
- Easy to change the program
- Fast response (Any 2 x 1 √√) (2)

6.4



STEP 1: The PLC reads the inputs via the input interface √

STEP 2: The PLC will now look at the first instruction in the program and execute it √

STEP 3: After the execution of the first instruction all the outputs will now be updated accordingly √

After step 3 the PLC will return to step 1 and repeat the process. √ (8)

6.5 6.5.1

SENSOR A	SENSOR B	SENSOR C	OUTPUT
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1 √
1	0	0	0
1	0	1	1 √
1	1	0	1 √
1	1	1	1 √

(4)

6.5.2 F = ABC + ABC + ABC + ABC (2 marks are awarded for the correct interpretation from the truth table in QUESTION 6.5.1, otherwise 0) √√ (2)

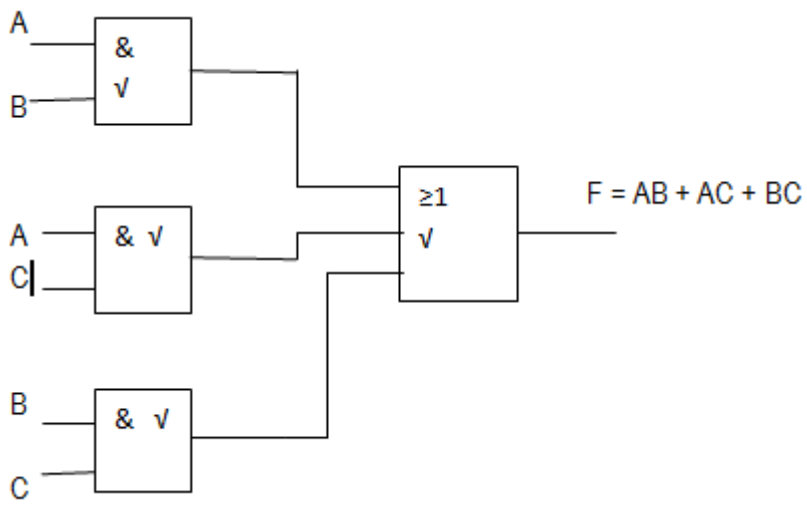
6.5.3

A \ BC	00	01	11	10
0	0	0	1	0
1	0	1	1	1

√ for correctly drawing the map;
√ for correctly entering logic levels

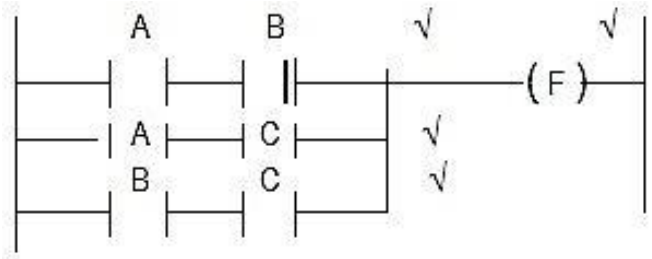
√ grouping $\bar{A}BC \; and \; ABC$
√ grouping $A\bar{B}C \; and \; ABC$
√ grouping $ABC \; and \; AB\bar{C}$
SIMPLIFICATION F = AB + AC + BC √

6.5.4



(4)

6.5.5



(4)
[40]

QUESTION 7: AMPLIFIERS

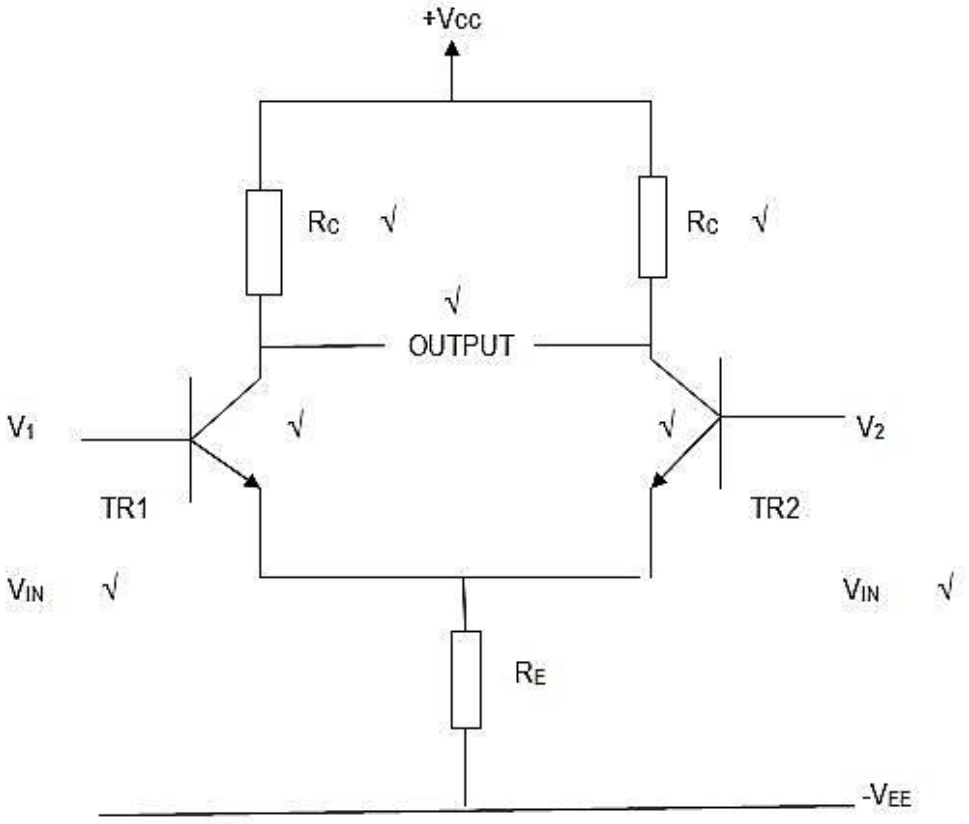
7.1
- Infinite open loop gain
- Infinite Bandwidth
- Infinite input impedance
- Output impedance = 0
- Infinite common mode rejection ratio
- Very high stability

(Any 3 x 1 √√√) (3)

7.2 7.2.1 Open loop gain in OP-AMPS means that there is no feedback resistor between the output and the inverting input. √√ (2)

7.2.2 Unwanted signals, such as interference √ might appear at the inverting and non-inverting inputs of the op-amp √ are not amplified. √ (3)

7.3



(7)

7.4 When a portion of the output signal is fed back to the input 180º out of phase with the input signal. √√ (2)

7.5
- Increase the bandwidth of the amplifier √
- Increases the stability of the amplifier √
- Reduces distortion and noise √ (3)

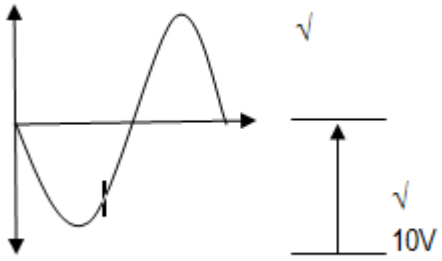
7.6 7.6.1 Summing amplifier √ (1)

7.6.2 Audio mixer √ (1)

7.6.3 $V_{OUT} = R_F\left(\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right)$ √

$= -10\text{ k}\left(\frac{0,2}{1\text{k}} + \frac{0,3}{1\text{k}} + \frac{0,5}{1\text{k}}\right)$ √

$= -10\text{ V}$ √



(5)

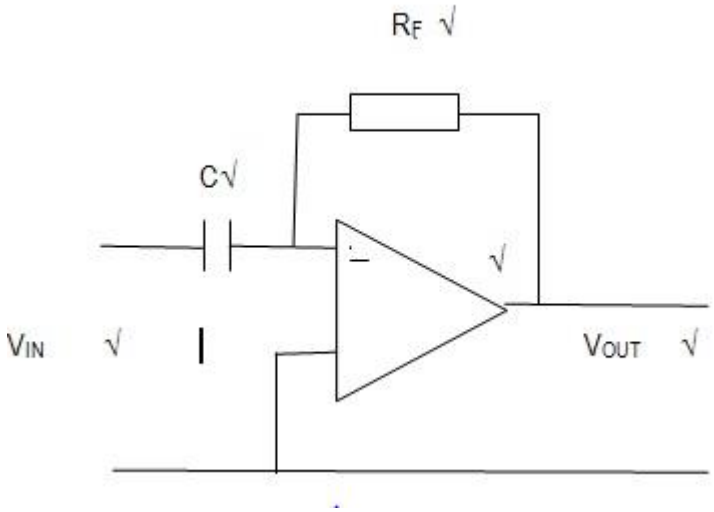
7.7 7.7.1 Hartley oscillator √ (1)

7.7.2 $f_r = \frac{1}{2\pi\sqrt{LC}}$ √

$= \frac{1}{2\pi\sqrt{10\times10^{-3}\times220\times10^{-9}}}$ √

= 3 393 Hz √ (3)

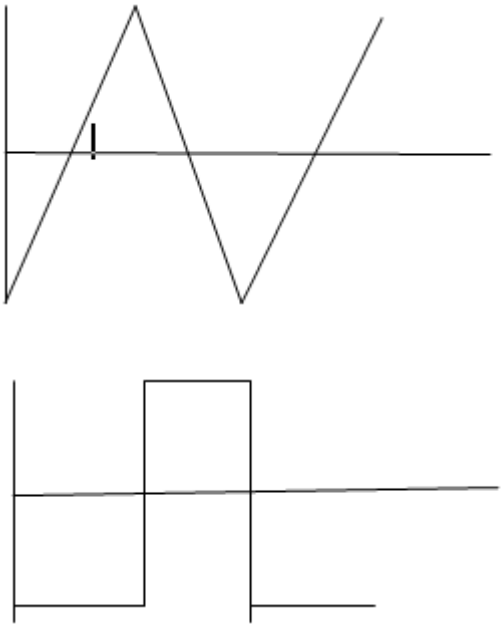
7.8 7.8.1



(5)

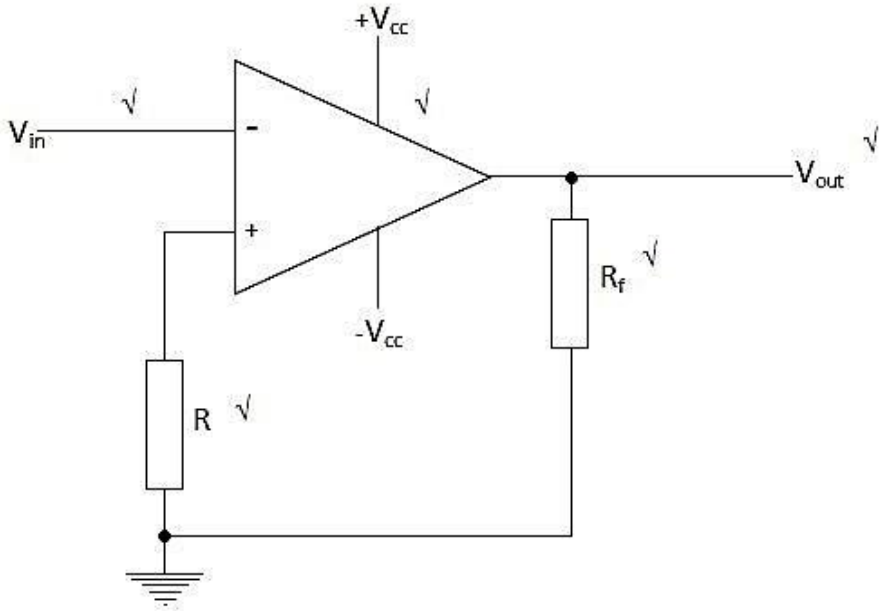
7.8.2 Monitoring the rate of temperature change in a furnace. √√ (2)

7.8.3



(2)

7.9 7.9.1



(5)

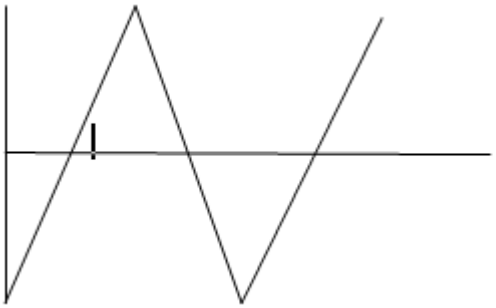
7.9.2
- Voltage sensitive switch
- Have two fixed trigger values (voltages)
- Supplies a digital output
- Output frequency is the same as input frequency
- Used as a wave shaper (Any 3 x 1 √√√) (3)

7.9.3
- Function generators √
- Digital counters √ (2)

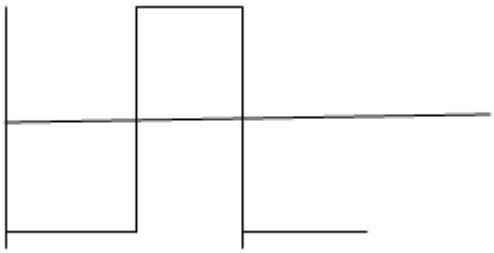
[50]

TOTAL: 200

7.8.3



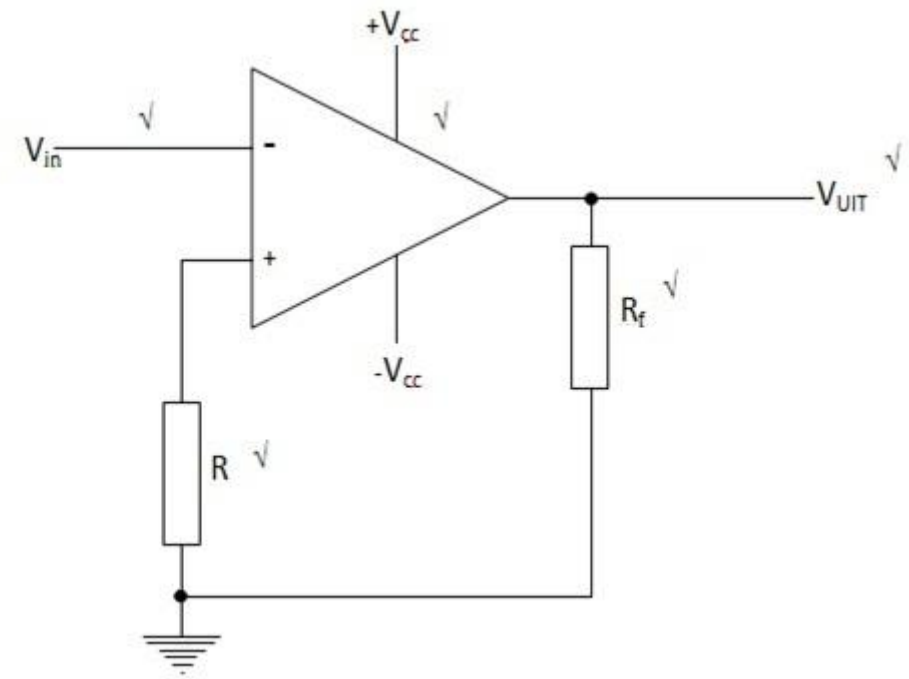
V_{IN} √



V_{UIT} √

(2)

7.9 7.9.1



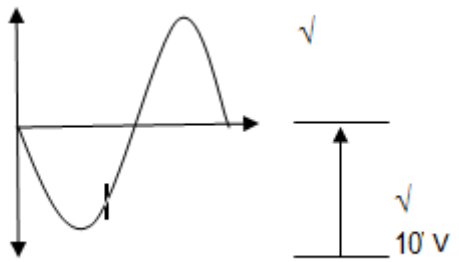
(5)

7.9.2
- Spanningsensitiewe skakelaar
- Het twee vaste snellerwaardes (spanning)
- Verskaf 'n digitale afvoer
- Uitsetfrekwensie is dieselfde as insetfrekwensie
- Word as 'n golfvormer gebruik (Enige 3 x 1 √√√) (3)

7.9.3
- Funksiegenerators √
- Digitale teller √ (2)

[50]

TOTAAL: 200



(5)

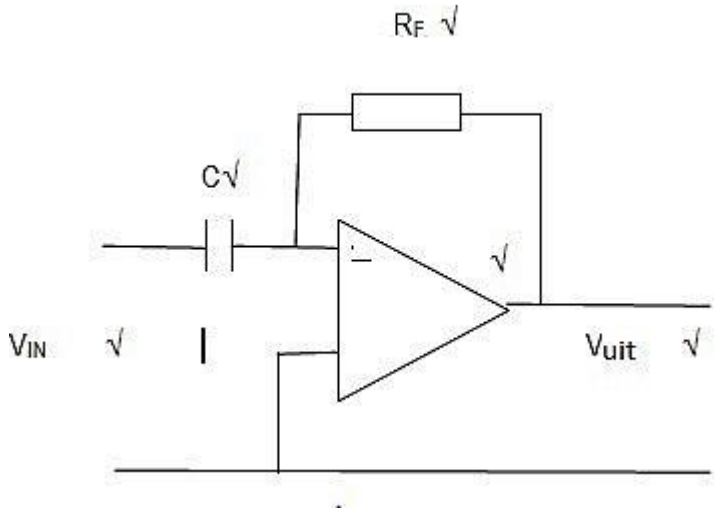
7.7 7.7.1 Hartley-ossilleerder √ (1)

7.7.2 $f_r = \frac{1}{2\pi\sqrt{LC}}$ √

$= \frac{1}{2\pi\sqrt{10 \times 10^{-3} \times 220 \times 10^{-9}}}$ √

$= 3\,393\ Hz$ √ (3)

7.8 7.8.1



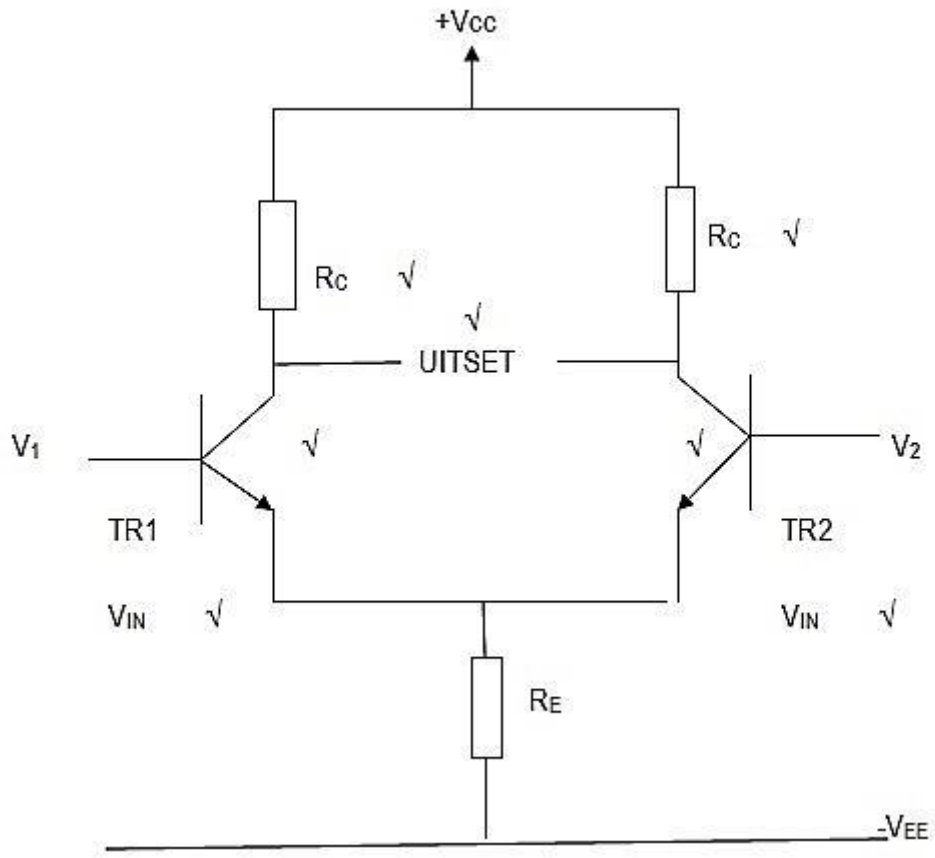
(5)

7.8.2 Monitering van die tempo van temperatuurverandering in 'n hoogoond. √√ (2)

7.2 7.2.1 Oop lus wins by OP-AMPS beteken geen terugkoppelweerstand tussen uitset en omkeerinset. √√ (2)

7.2.2 Ongewenste seine soos steurnings √ wat by die omkeer en nie-omkeerinsette √ verskyn, sal nie versterk word nie. √ (3)

7.3



(7)

7.4 Wanneer 'n deel van die uitsetsein180º uit fase met die insetsein teruggevoer word. √√ (2)

7.5
- Toename in bandwydte van die versterker. √
- Verhoogde stabiliteit. √
- Verminder verwringing en geraas. √ (3)

7.6 7.6.1 Sommeerversterker √ (1)

7.6.2 Oudiomenger √ (1)

7.6.3
$$V_{UIT} = R_F\left(\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right) \quad \surd$$
$$= -10\,k\left(\frac{0{,}2}{1k} + \frac{0{,}3}{1k} + \frac{0{,}5}{1k}\right) \surd$$
$$= -10\,V \quad \surd$$

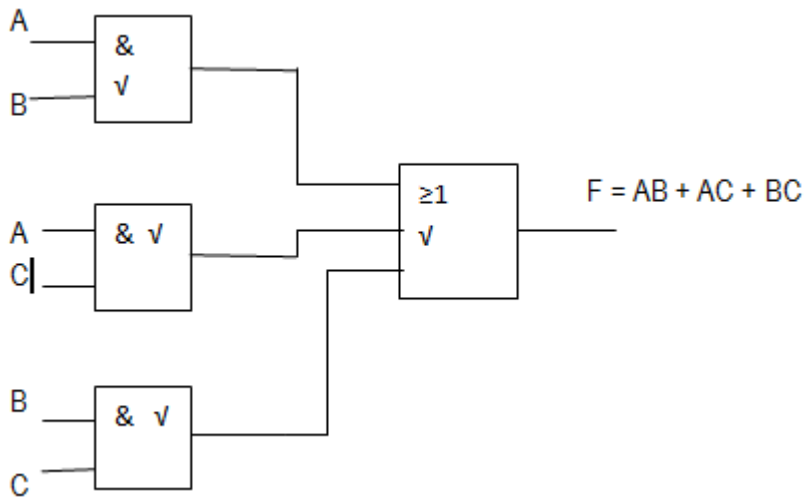
6.5.3 A

A \ BC	00	01	11	10
0	0	0	1	0
1	0	1	1	1

√ korrekte tekening van kaart
√ korrekte inset van logikavlakke

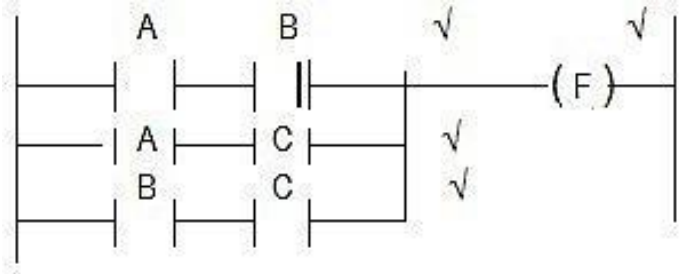
√ groepering $\bar{A}BC$ *en* ABC
√ groepering $A\bar{B}C$ *en* ABC
√ groepering ABC *en* $AB\bar{C}$
VEREENVOUDIGING F = AB + AC + BC √

6.5.4



(4)

6.5.5

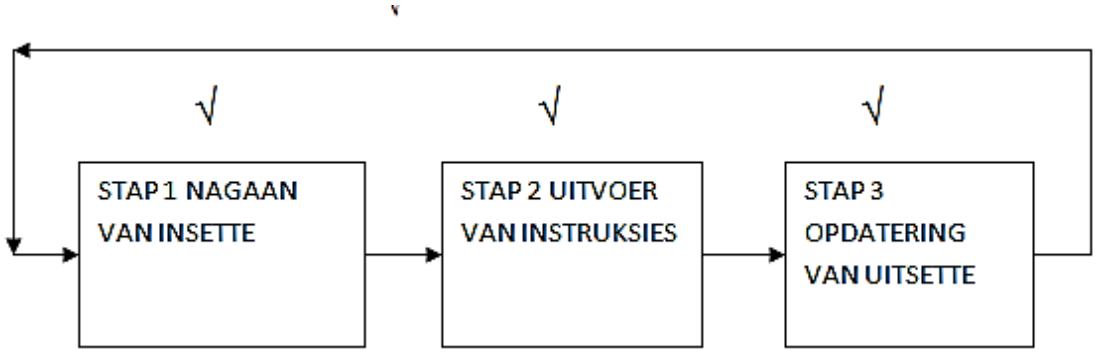


(4)
[40]

VRAAG 7: VERSTERKERS

7.1
- Oneindige oop lus wins
- Oneindige bandwydte
- Oneindige insetimpedansie
- Uitsetimpedansie = 0
- Oneindige gemeenskaplike modusverwerpingsverhouding
- Baie hoë stabiliteit (Enige 3 √√√) (3)

6.4



STAP 1: Die PLB lees die insette deur die inset-koppelvlak √

STAP 2: Die PLB sal eers na die eerste instruksie in die program kyk en dit uitvoer √

STAP 3: Na uitvoering van die eerste instruksie sal alle uitsette dienooreenkomstig opgedateer word √

Na stap 3 sal die PLB weer by stap 1 begin en die proses herhaal. √ (8)

6.5 6.5.1

SENSOR A	SENSOR B	SENSOR C	UITSET
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1 √
1	0	0	0
1	0	1	1 √
1	1	0	1 √
1	1	1	1 √

(4)

6.5.2 F = ABC + ABC + ABC + ABC (2 punte word gegee vir die korrekte interpretasie van die waarheidstabel in VRAAG 6.5.1; indien nie reg nie dan 0) √√ (2)

5.3.4 $\frac{1}{2\pi fc} = \frac{V_S}{I_C}$ √

Xc $= \frac{100}{7.325}$ √ $= 13{,}65\ \Omega$ √

$C = \frac{1}{2\pi fXc}$ √

$c = \frac{1}{2\pi\ x\ 50\ x\ 13{,}65}$ √

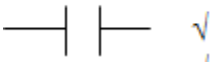
$= 233\ \mu F$ (6)

[20]

VRAAG 6: LOGIKA

6.1
- Kragtoevoer √
- Inset/Uitset-module √
- Verwerker √
- Programmeringstoestel √ (4)

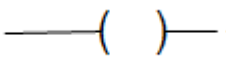
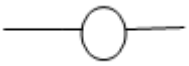
6.2


√

normaalweg oop kontak √

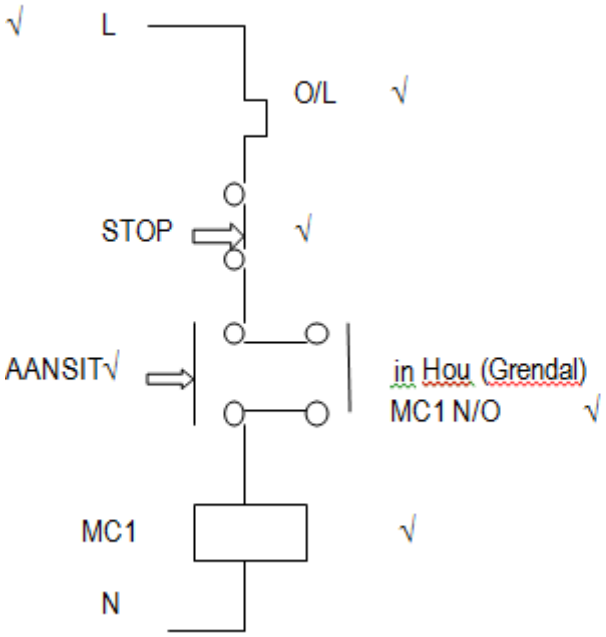

√

normaalweg geslote kontak √


√ of  uitset √ (6)

6.3
- PLB'e is vastetoestand-toestelle wat relatief klein is
- Gebruik ongeveer 10% van die krag wat relê-logika gebruik
- Hou lank en minder instandhouding
- Meer bekostigbaar/ekonomies
- Geen bewegende onderdele, gevolglik meer betroubaar.
- Maklik om die program te verander
- Vinnige reaksietyd (Enige 2 x 1 √√) (2)

4.8



(6)
[40]

VRAAG 5: RLC-KRINGE

5.1 5.1.1 X_L verhoog (1)

5.1.2 X_C daal (1)

5.2 $X_L = X_C$
Z is minimum
Z = R
I is by maksimum
cos θ = 1
θ = 0^o (Enige 2 x 1 √√) (2)

5.3 5.3.1 $I_R = \frac{V_S}{R} = \frac{100}{50} = 2\ A$ (3)

5.3.2 $I_L = \frac{V_S}{X_L} = \frac{100}{31,42} = 3,183\ A$ (3)

5.3.3 $I_C - I_L = \sqrt{I_T^2 - I_R^2}$

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

$= \sqrt{4,6^2 - 2^2} + 3,183$

$= 7,325\ A$ (4)

4.7 4.7.1 $S = \frac{P}{\cos\theta}$

$= \frac{90\ 000}{0,85}$

$= 105,88$ kVA (3)

4.7.2 $I_L = \frac{P}{\sqrt{3}V_L \cos\theta}$

$= \frac{90\ 000}{\sqrt{3} \times 400 \times 0,85}$

$= 152,83$ A (3)

4.7.3 $\cos\theta = 0,85$

$\theta = \cos^{-1} 0,85$

$= 31,79°$ (3)

4.7.4 $N_S = \frac{60 \times f}{p}$

$= \frac{60 \times 50}{2}$

$= 1\ 500$ OPM (4)

4.7.5 $Glip = \frac{N_S - N_R}{N_S} \times 100\%$

$= \frac{1\ 500 - 1\ 400}{1\ 500} \times 100$

$= 6,67\%$ (3)

3.2.5 $I_{PH} = \frac{I_L}{\sqrt{3}}$

$= \frac{33,18}{\sqrt{3}}$

$= 19,16$ A (3)

3.3
- Lug-blaas-tipe (of lugventilasie-tipe)
- Oliegevulde selfverkoelde tipe
- Oliegevulde waterverkoelde-tipe (Enige 2 x 1 √√) (2)

[20]

VRAAG 4: DRIE-FASE MOTORE EN AANSITTERS

4.1
- Rotor √
- Stator √
- Statorwikkelings √

(Aanvaar eindplate ook) (3)

4.2
- Wanneer die driefase-toevoer aan die motor verbind word, word 'n roterende statorveld outomaties opgewek. √
- Hierdie roterende statorveld sny die metaalstawe van die kourotor en induseer 'n groot stroom daarin. √
- Hierdie geïnduseerde strome in die rotor skep hulle eie rotor-magnetiese veld. √
- Die roterende statorveld en die rotor-magnetiese velde reageer met mekaar. √
- Krag word tussen die twee velde uitgeoefen (dit word wringkrag genoem) en die rotor begin in dieselfde rigting as die roterende statorveld draai. √
- Namate die rotorspoed toeneem, word minder stroom in die metaalstawe van die rotor geïnduseer, omdat die relatiewe spoed tussen die roterende statorveld en die rotorspoed verander het namate die rotor se spoed toegeneem het. √ (6)

4.3 Ruil enige twee fases om. √ (1)

4.4 Indien daar 'n kragonderbreking gebeur sal die stelsel afskakel. √ Wanneer die krag herstel is, sal die stelsel nie self aanskakel nie. Dit sal weer met die hand aangesit moet word. √ (2)

4.5 Wanneer die aansitskakelaar gedruk word, √ sal die spoel van die kontaktor bekrag word en die normale oop kontakte sal sluit, insluitende die in-hou kontak wat (in parallel met die aansitskakelaar) die stroombaan na die kontaktorspoel voltooi. √ Die kontaktor sal aangeskakel bly totdat die stopknoppie gedruk word, √ of die toevoer afskakel. √ (4)

4.6
- Kontinuïteit/weerstandstoets
- Isolasieweerstand tussen spoele
- Isolasieweerstand tussen spoele en aard
- Soek vir oopdrade
- Kontroleer elektriese verbindings in die terminaal-kas (Enige 2 x 1 √√) (2)

VRAAG 3: DRIE-FASE TRANSFORMATORS

3.1
- Identiese windingsverhoudings
- Identiese spannings- en stroomaanslag
- Identiese drywingaanslag
- Identiese arbeidsfaktor
- Identiese rendement
- Identiese grootte

(Enige 3 x 1 √√√) (3)

3.2 3.2.1 $V_{L(SEKONDÊRE)} = V_{L(LAS)} = 400\ V$

$P = \sqrt{3}\, V_L I_L \cos\theta$

$I_{L(SEKONDÊRE)} = \dfrac{P}{\sqrt{3} V_L \cos\theta}$

$= \dfrac{300\,000}{\sqrt{3} \times 400 \times 0{,}87}$

$= 497{,}72\ A$ (3)

3.2.2 $I_{PH} = \frac{I_{LS}}{\sqrt{3}}$ √

$= \frac{497{,}72}{\sqrt{3}}$ √

$= 287{,}36\ A$ √ (3)

3.2.3 $S = \frac{P}{\cos\theta}$ √

$= \frac{300\,000}{0{,}87}$ √

$= 344{,}83\ kVA$ √

OF

$S = \sqrt{3} V_L I_L$

$= \sqrt{3 \times 400 \times 497{,}72}$

$= 344{,}83\ kVA$ (3)

3.2.4 $S_{PRIMÊRE} = S_{SEKONDÊRE} = 344{,}83\ kVA$

$I_L = \dfrac{S}{\sqrt{3} V_L}$

$\dfrac{344{,}83}{\sqrt{3} \times 6\,000}$

$= 33{,}18\ A$ (3)

Die las

- Driefasemotors is doeltreffender.
- Driefasemotors het 'n hoër arbeidsfaktor.
- Driefasemotors het 'n veel hoër aansitdrywing.
- Driefasemotors het nie bykomende aansitstroombane nodig nie.
- Vir drie- en enkelfasemotors van soortgelyke fisiese groottes, sal driefase meer drywing lewer.
- Driefase kan in ster of delta gekoppel word. (Enige 1 x 2 √√) (6)

2.4 2.4.1 $V_L = \sqrt{3} \times V_{PH}$ √

$= \sqrt{3} \times 240$ √

$= 415{,}69$ V √ (3)

2.4.2 $S = \sqrt{3} I_L V_L$

$I_L = \frac{S}{\sqrt{3} V_L}$ √

$= \frac{15\,000}{\sqrt{3} \times 415{,}69}$ √

$= 20{,}83$ A √ (3)

2.4.3 $P = \sqrt{3} I_L V_L \cos\theta$ √

$= \sqrt{3} \times 20{,}83 \times 415{,}69 \times 0{,}87$ √

$= 13{,}05$ kW √

OF

$P = S \cos\theta$

$= 15\,000 \times 0{,}87$

$= 13{,}05$ kW (3)

[20]

VRAAG 1: BEROEPSGESONDHEID EN VEILIGHEID

1.1 'n Ongeluk is 'n onbeplande, √ onbeheerde gebeurtenis √ wat deur onveilige optrede en toestande veroorsaak word. √ (3)

1.2 Nee. √ Die werker het die reg op privaatheid. √ (2)

1.3
- Wend direkte druk aan, of gebruik 'n drukverband. √
- Hou die slagoffer kalm. √
- Hou die bloedingspunt, indien moontlik, bokant die hartvlak. √
- Wanneer daar ernstige bloeding is waar 'n groot slagaar afgesny is, kan druk onvoldoende wees en is dit nodig om 'n aarpers (klemverband) te gebruik. √
- Die druk van hierdie aarpers (klemverband) moet periodiek verlig word om te verhoed dat skade aan die weefsel aangerig word. √ (5)

[10]

VRAAG 2: DRIE-FASE WS-OPWEKKING

2.1 (Die vraag handel oor metodes wat in Suid-Afrika gebruik word.)
- Wind
- Son-energie
- Hidroëlektries
- Gepompte opberging (Enige 2 x 1 √√) (2)

2.2
- Koperverliese
- Ysterverliese of kernverliese
- Wrywingsverliese
- Windverliese (Enige 3 x 1 √√√) (3)

2.3 <u>Opwekkingsproses</u>
- Vir drie- en enkelfase-alternators van soortgelyke fisiese groottes, sal drie-fase meer drywing opwek.
- Driefase krag voorsien drywing aan enkel- of driefase-laste.
- Driefase is goedkoper om te genereer.
- Driefase vereis minder instandhouding.
- Driefase het twee verbindings opsies, naamlik ster en delta.

(Enige 1 x 2 √√)

<u>Verspreiding- en -transmissieproses</u>
- Laer strome beteken minder hitte.
- Minder hitte beteken minder verliese.
- Laer stroom beteken dat dunner kabels kan gebruik word en dit bring bykomende kostebesparings mee.
- Spanmaste (of traliemaste) wat nodig is om dunner kabels te steun, verg minder metaal gedurende konstruksie, met gepaardgaande kostebesparing.
- 'n Neutrale punt is beskikbaar wanneer daar in ster verbind word.
- Lasverspreiding en fase-balansering word moontlik gemaak.

(Enige 1 x 2 √√)

Province of the
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EDUCATION

NASIONALE SENIOR SERTIFIKAAT

GRAAD 12

SEPTEMBER 2014

ELEKTRIESE TEGNOLOGIE MEMORANDUM

PUNTE: **200**

Hierdie memorandum bestaan uit 13 bladsye.