GAUTENG DEPARTMENT OF EDUCATION
GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

TECHNIKA (ELECTRICAL / *ELEKTRIES*) SG

POSSIBLE ANSWERS OCT / NOV 2006

QUESTION / VRAAG 1

1.1

$$X_L = 2\Pi fl$$
$$= 2\Pi 60x0{,}14$$
$$= 52{,}78\,\Omega$$

$$X_C = \frac{1}{2\Pi Fc}$$
$$= \frac{1}{2\Pi \text{ 60 x 49 x } 10^{-6}}$$
$$= 54{,}13\,\Omega$$

$$z = \sqrt{R^2 + (X_C - Xl)^2}$$
$$= \sqrt{40^2 + (54{,}13 - 52{,}78)^2}$$
$$= 40{,}02\,\Omega$$

(9)

1.1.2

$$I = \frac{V}{Z}$$
$$= \frac{220}{40{,}02}$$
$$= 5{,}497\,A$$

(3)

1.1.3

$$\cos\varnothing = \frac{R}{Z}$$
$$= \frac{40}{40{,}02}$$
$$= 1{,}8^0$$

(4)

1.1.4

$$Zcoil = \sqrt{R^2 + Xl^2}$$
$$= \sqrt{40^2 + 52{,}78^2}$$
$$= 66{,}22\,\Omega$$

$$V = I.Z$$
$$= 5{,}497\,x\,66{,}22$$
$$= 364{,}03\,V$$

(6)

1.2

$$Xl = 2\pi fl$$
$$= 2\pi\,325000\,x\,(120x10^{-6})$$
$$= 245{,}06\,\Omega$$

$$Q = \frac{Xl}{R}$$
$$= \frac{245{,}04}{42}$$
$$= 5{,}83$$

(6)

1.3.1

$$It = \sqrt{Ir^2 + (Il - Ic)^2}$$
$$= \sqrt{0{,}83^2 + (0{,}625 - 0.455)^2}$$
$$= 0{,}847\,A$$

(3)

1.3.2

$$\cos\theta = \frac{Ir}{It}$$
$$= \frac{0{,}83}{0{,}847}$$
$$= 11{,}49^0$$

(4)

1.3.3

$$Xl = \frac{V}{Il} \qquad L = \frac{XL}{2\pi F}$$
$$= \frac{200}{0{,}625} \qquad L = \frac{320}{2\pi 50}$$
$$= 320\,\Omega \qquad = 1{,}018H$$

(6)

1.4 X_l increases and current decreases/X_l styg en stroom daal vv (2)

1.5 When X_l = Xc or at resonance/Wanneer X_l = Xc of resoneer vv (2)

[45]

QUESTION /VRAAG 2

2.1.1

$$Pap = V.I$$
$$= 250\text{x}20$$
$$= 5000\,VA$$

(3)

2.1.2

$$P = VI\cos\theta$$
$$= 5000\text{x}0{,}8$$
$$= 4000\,W$$

(3)

2.1.3 $\text{COS}\varnothing = 0{,}8$

$\varnothing = 36{,}86$

(2)

2.2 3 phase 2 voltages are available/*3-fase spannings is beskikbaar*
3 phase motors are cheaper (smaller) and more efficient (self starting)
3-fase motors is goedkoper (kleiner) en doeltreffender (selfaktiverend).
Any one of the above/*Enige een van bogenoemde* vv (2)

[10]

QUESTION /VRAAG 3

3.1 To remove the moisture from the air/*Om die vog uit die lug te verwyder* vv (2)

3.2 For cooling or improves the insulation of the transformer.
Om af te koel of om die isolering van die transformator te verbeter. vv (2)

3.3.1

$$Vph_{\text{sec}} = \frac{Vl_{\text{sec}}}{\sqrt{3}}$$
$$= \frac{500}{\sqrt{3}}$$
$$= 288{,}67\,V$$

(2)

3.3.2

$$\text{Primary}: Vl = V_{ph}$$
$$= 11000\,V$$
$$= Vp : V\,\text{sec}$$
$$= 11000 : 288{,}67$$
$$= 38 : 1$$

(3)

3.3.3

$$\frac{Np}{Ns} = \frac{38}{1}$$
$$\frac{5000}{38} = Ns$$
$$132_{Turns} = Ns$$

(3)

3.3.4

$$I_{ph} = \frac{I_l}{\sqrt{3}}$$
$$= \frac{5}{\sqrt{3}}$$
$$= 2{,}88\,A$$

(2)

3.3.5

$$\frac{V_p}{V_s} = \frac{I_s}{I_p}$$
$$I_s = \frac{11000 \times 2{,}88}{288{,}67}$$
$$I_s = 109{,}7\,A$$

(3)

3.3.6

$$P = 3V_{phase} I_{\text{phase}} \cos\theta$$
$$= 3\text{x}288{,}67\text{x}109{,}7\text{x}0{,}6$$
$$= 57\,kW$$

(3)

[20]

QUESTION / VRAAG 4

4.1 Synchronous speed is the speed at which the rotating magnetic field rotates. Rotor speed is the speed at which the rotor rotates. Rotor speed is synchronous speed minus slip/ vv
Sinchrone spoed is die spoed waarteen die roterende magneetveld draai. Rotorspoed is die spoed waarteen die motor draai. Rotorspoed is sinchrone spoed minus glip. (2)

4.2

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

$$I_L = \frac{50000}{\sqrt{3} \times 380 \times 0{,}85 \times 0{,}8}$$

$$I = 111{,}7\,A$$

(6)

4.3 Current drawn is too high and overload not working
Motor too small for the load
Running or starting winding faulty
Any two of the above
Stroom wat getrek word is te hoog en oorbelasting werk nie
Motor te klein vir die las
Loop of aansit ontwikkeling foutief
Enige twee van twee bogenoemdes (2)

4.4

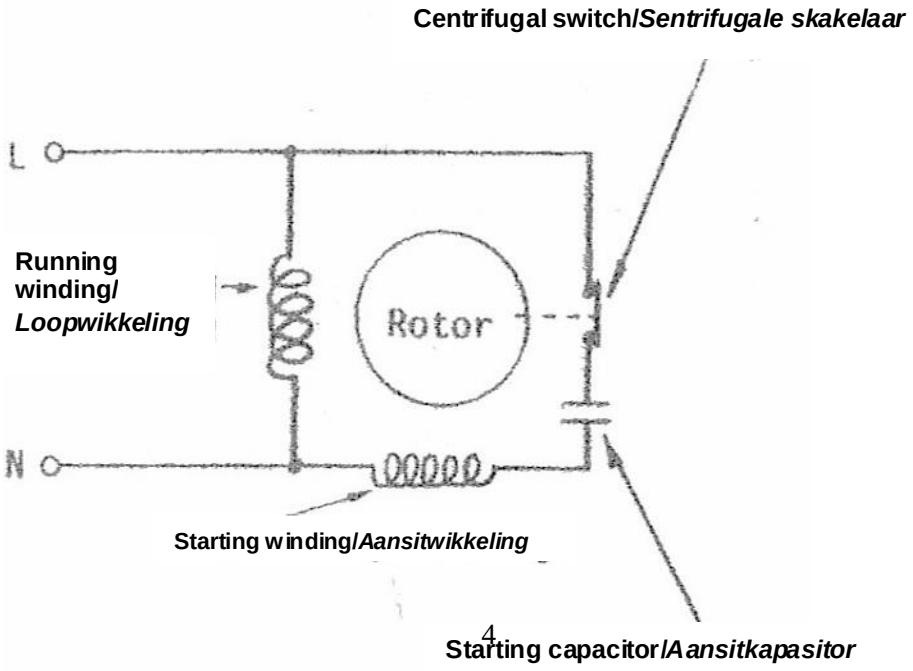
$$Ns = \frac{F}{P} \times 60 \qquad S = \frac{Ns - Nr}{Ns} \times 100$$

$$= \frac{50}{2} \times 60 \qquad = \frac{1500 - 1425}{1500} \times 100$$

$$= 1500\,rpm \qquad = 5\%$$

(6)

4.5



(4)

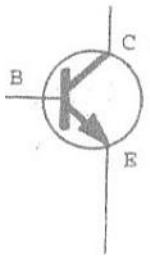
4.6 Fans or Record Players/*Waaiers of platespelers* (2)

4.7 To produce a constant torque and to operate at a better power factor/
Om ? konstante draaimoment op te wek en by ? beter kragfaktor te werk. (3)

[25]

QUESTION / VRAAG 5

5.1.1 NPN Transistor 5.1.2 Diac/*Diak* (2x2) = (4)



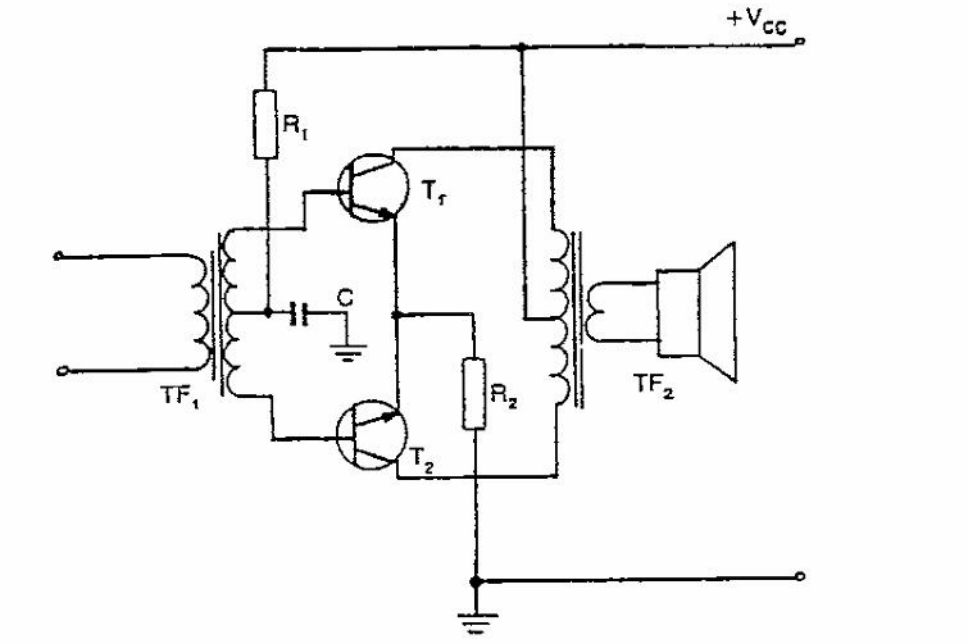
5.2 Base must be positive./*Basis moet positief wees.*
Collector must be positive with respect to the emitter/*Kollektor moet positief wees met betrekking tot die emitter.* (4)

5.3 Zener diode works in reverse bias conditions
Junction diode works in forward bias conditions
Zener diode werk in teenvoorspanning-toestamde
Voegdiodes werk in voorspanning-toestande (2)

[10]

QUESTION / VRAAG 6

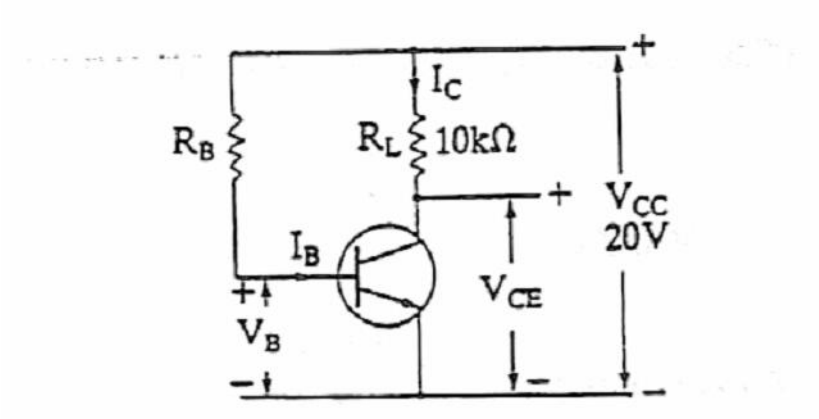
6.1



(8)

6.2 Class B amplification/*Klas B-versterking* (2)

6.3



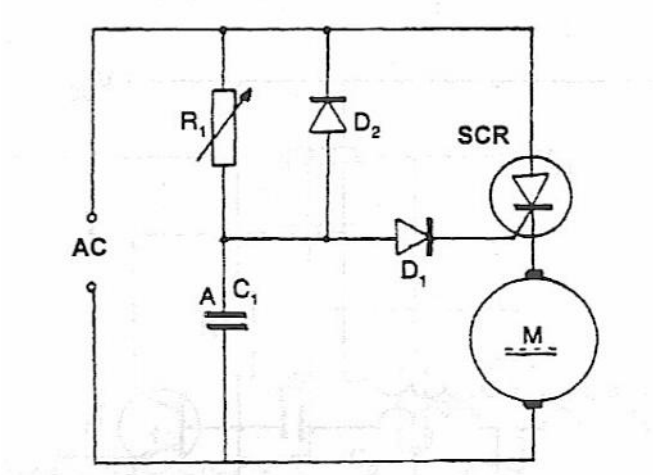
R_B provides the voltage to bias the EB of the transistor. The input coupling capacitor blocks DC and allows AC to pass through. A constant DC flows through RL. This constant current develops a constant voltage across the output of the transistor. A positive pulse on the base increases the forward bias conditions and turns the transistor harder on allowing more current to flow and increase the output wave 180 degrees out of phase with the input wave.
R_B verskaf die spanning om voorspanning aan die EB van die transistor te gee. Die insetkoppelingkapasitor blokeer GS, maar laat WS toe om daardeur te vloei. Hierdie konstante stroom ontwikkel ? konstante spanning oor die uitset van die transistor. ? Positiewe puls op die basis verhoog die voorspanningstoestande en draai die transistor harder om meer stroom daardeur te laat vloei en vergroot die golf 180 grade uit fase met die insetgolf. (8)

6.4 Expensive/*Duur*
Large and heavy/*Groot en swaar*
Poor frequency range/*Swak frekwensiebestek* (2)
[20]

QUESTION / VRAAG 7

7.1 The output of a regulated power supply must remain constant even with a change in the input./*Die uitset van ? gereelde kragtoevoer moet konstant bly, selfs al verander die invoer.* (2)

7.2



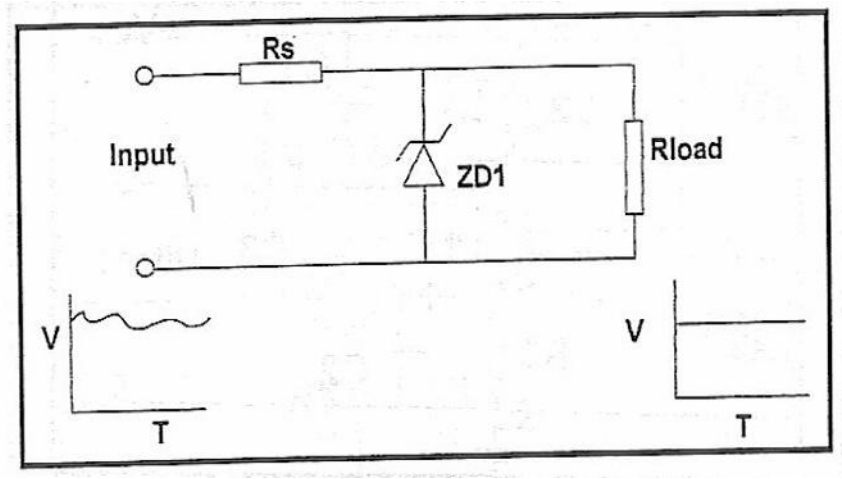
(10)

The speed of the motor is determined by the rate at which C_1 charges and discharges. R_1 determines the rate at which C_1 charges and discharges. The slower the rate of charge the higher the output of the motor./
Die spoed van die motor word bepaal deur die tempo waarteen C_1 en C_2 ontlaai. R_1 bepaal die koers waarteen C_1 laai en ontlaai. Hoe stadiger die laaikoers, hoe hoër die uitset van die motor.

7.3 Power supply needs to be earthed/*Kragtoevoer moet geaard wees* (2)
You need to be earthed/*Jy moet geaard wees.*

7.4 Remove the holding current (Disconnect the SCR)/
Verwyder die houstroom (Ontkoppel die BSG) (2)
Voltage across the SCR falls to zero/*Spanning oor BSG daal na nul*
(One of the above/*Een van die bogenoemdes)*

7.5

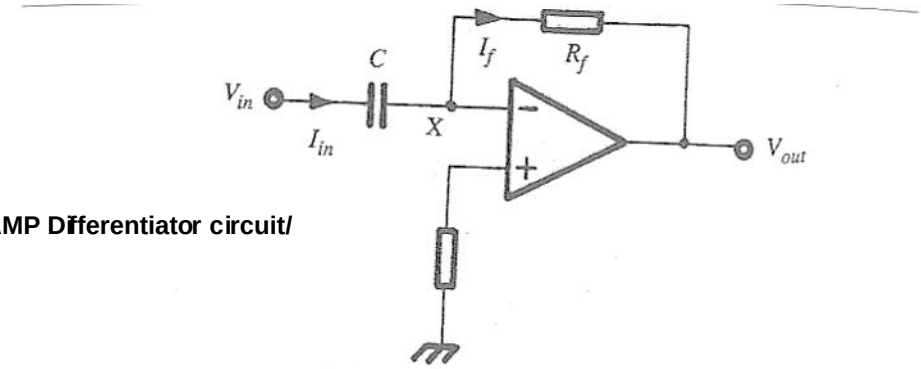


(4)

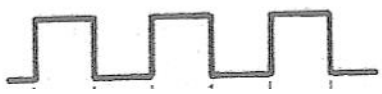
[20]

QUESTION / VRAAG 8

8.1 (10)



An OP AMP Differentiator circuit/



Input signal/

Output/

[10]

QUESTION / VRAAG 9

9.1.1 When part of the output signal is fed back to the input signal and is in phase with the input signal
Wanneer ? gedeelte van die uitsetsein teruggevoer word na die insetsein en in fase is daarmee. (2)

9.1.2 Tank circuit inductor is connected in parallel with a capacitor and the energy resonates between the two components/
Tenkkring induktor word in parallel aan ? kapasitor verbind en die energie tussen die twee komponente resoneer. (2)

9.1.3 Charge produced by a crystal, when a pressure is applied across the crystal/
Lading wat deur kristal opgewek word wanneer druk daarop toegepas word (2)

9.2 To stabilise the feedback frequency/
Om die terugvoerfrekwensie te stabiliseer (2)

9.3 Controls the number of sine pulses per time unit that goes through to the counter/
Beheer die aantal sinusgolwe per tydeenheid wat deur die teller beweeg. (2)

[10]

QUESTION /VRAAG 10

10.1.1 (8)

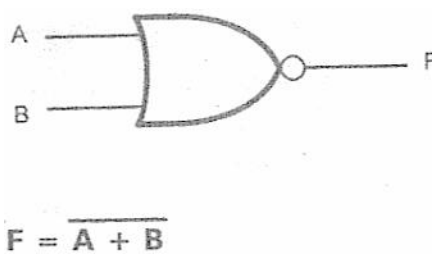
A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

10.1.2 $A.B.\bar{C} + A.\bar{B}.\bar{C} + A\bar{B}.C + A.B.C = F$ (4)

A	B	$\bar{A}$	$\bar{B}$	A+B	$\overline{A+B}$	$\bar{A}.\bar{B}$
0	0	1	1	0	1	1
0	1	1	0	1	0	0
1	0	0	1	1	0	0
1	1	0	0	1	0	0

(6)

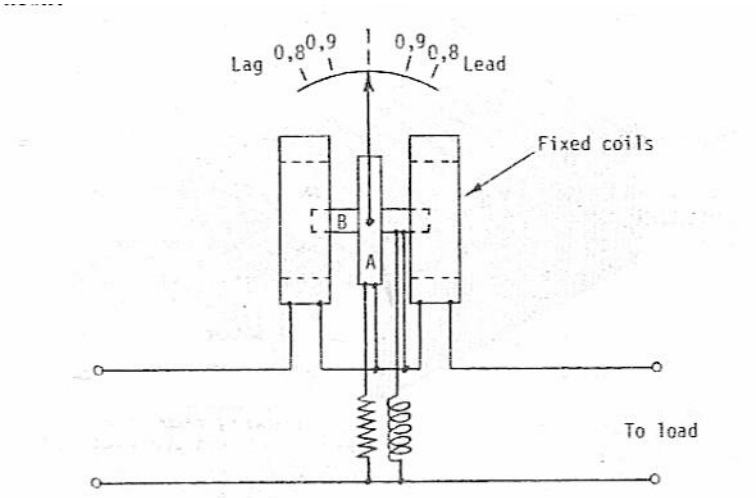
10.3 (2)



[20]

QUESTION / VRAAG 11

11.1 Power factor meter/*Kragmeter* (6)



11.2 To show wave shapes/*Om die golfvorms te toon*
To measure voltages and phase angles/*Om die spannings en fasehoeke te meet*
To measure frequencies/*Om frekwensies te meet*
Diagnostic testing/*Diagnostiese toetsing*
Any two of the above/*Enige twee van die bo genoemdes* (2)

11.3 Electro-magnetic or Electro-static deflection/
Elektromagnetiese of elektrostatiese defleksie (2)
[10]

TOTAL / *TOTAAL*: 200