GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

ELECTRICIANS WORK SG

Possible Answers / Moontlike Antwoorde
Feb / Mar / Maart 2006

QUESTION 1
ELECTRICAL CURRENT THEORY

1.1.1 $XL = 2\pi FL$ (1)
$= 2\pi \times 50 \times 0,2$ (1)
$= 62,83$ ohm (1)

$Z = \sqrt{R^2 + (XL - XC)^2}$ (1)
$= \sqrt{8^2 + (62,83-12)^2}$ (1)
$= \sqrt{2\,647,6}$ (1)
$= 51,46$ ohm (1)
$V = I \times Z$ (1)
$= 1,2 \times 51,46$ (1)
$= 61,75$ V (1)
[10]

1.1.2 $\cos\Ø = R / Z$ (1)
$\cos\Ø = 8 / 51,46$
$\cos\Ø = 0,155$ (1)
$P = VI \cos\Ø$ (1)
$= 61,75 \times 1,2 \times 0,155$ (1)
$P = 11,485$ W (1)

OR

$P = I^2R$ (1)
$= 1,2^2 \times 8$ (2)
$= 11,52$ W (2)
[5]

1.1.3 $X_C = \frac{1}{2\Pi FC}$ (1)

$C = \frac{1}{2\Pi FX_C}$ (1)

$C = \frac{1}{2 \times \Pi \times 50 \times 12}$ (1)

$C = 265 \times 10^{-6}F.$ (1)

$= 265\ \mu F$ (1)

[5]

[20]

1.2

Midordinates	**Midordinates^2**
6	36
13,5	182,25
15,15	240,25
15	225
10	100
3	9
63	792,5

Average value = e1 + e2 + e3 + e4 ..... e6 / no of midordinates (1)

= 63/6 (2)

= 10,5 V (1)

Rms value = $\sqrt{e1^2 + e2^2 + e3^2 + ...e6^2 / \text{no of midordinates}}$ (1)

= $\sqrt{792,5 / 6}$ (2)

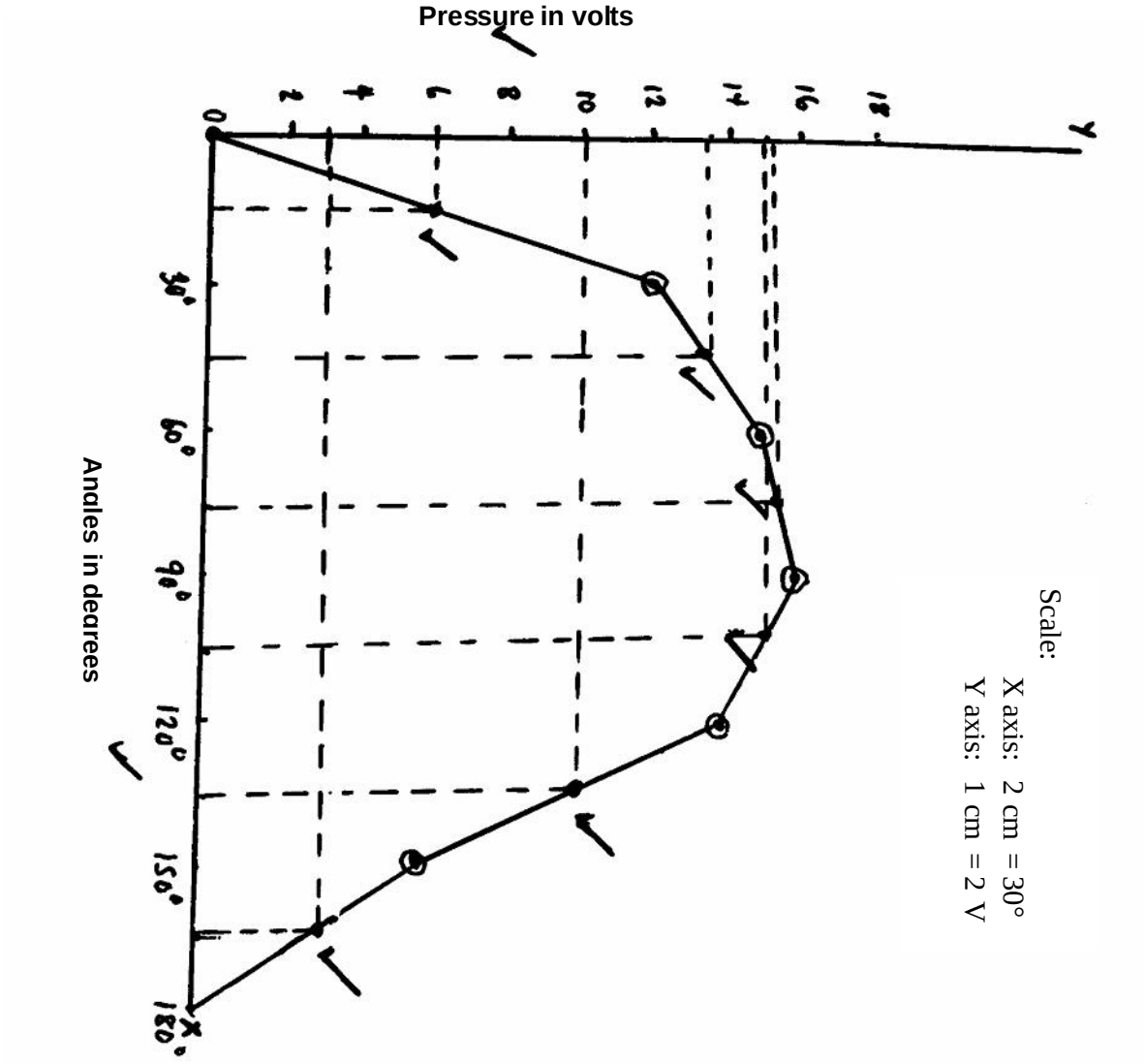
= 11,49 V (1)

Form factor = rms / ave (1)

= 11,49 / 10,35 (2)

= 1,094 (1)

GRAP H



(8)
[20]

1.3.1	Irms	=	0,707 x Im	(1)
		=	0,707 x 75	(1)
		=	53,025 A	(1)
1.3.2	2?f	=	563	(1)
	f	=	563/2?	(1)
		=	89,6 Hz	(1)

1.3.3 $i = 75 \sin(563t)$ (1)

$= 75 \sin(563 \times 3 \times 10^{-3})$ (1)

$= 75 \sin(1{,}689 \text{ rad})$

$= 75 \sin(1{,}689 \times 57{,}3)$ (1)

$= 75 \sin 96{,}77$

$= 74{,}47 \text{ A}$ (1)

[10]

1.4 Welding machines (1)

Induction motors (1)

Transformers (1)

[3]

1.5 $F = 1 / T$ (1)

$= 1 / 0{,}005$ (1)

$= 200 \text{ Hz}$ (1)

[3]

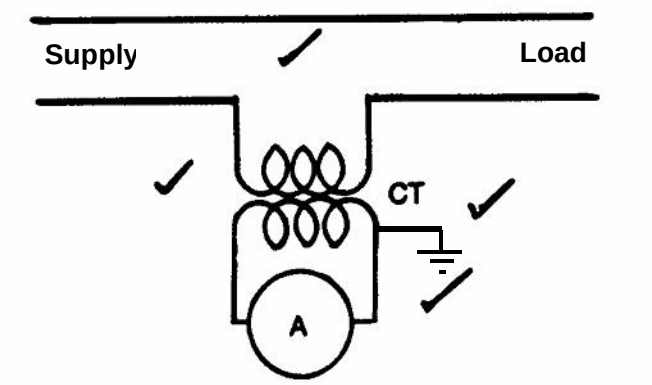
1.6 0° **[2]**

1.7 ? rad = 180° **[2]**

[60]

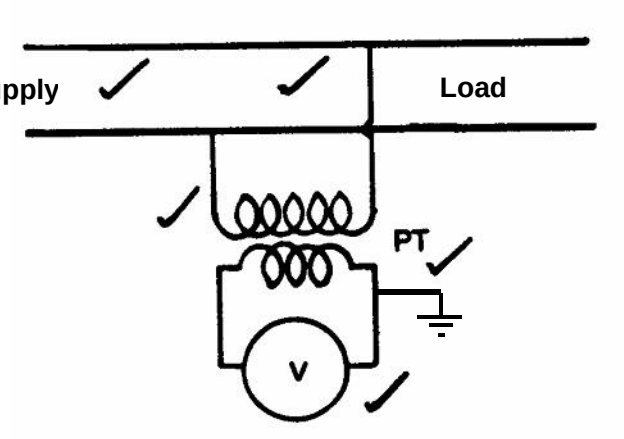
QUESTION 2

2.1.1



(4)

2.1.2



(5)
[9]

2.2.1 Construction

It comprises a number of reeds (thin steel strips) 'tuned' to vibrate at different frequencies by varying their length.
They are placed in front of a laminated iron core around which an exciting coil is wound. (5)

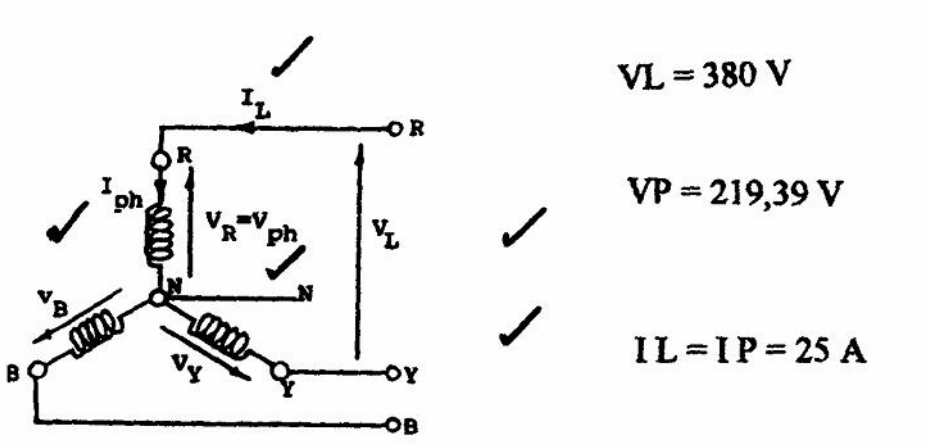
2.2.2 Operation

The exciting coil is connected across the supply of which the frequency is to be measured, which sets up an alternating flux. This alternating flux will cause the reed tuned to that frequency to vibrate and its tip, which is painted, will appear to be drawn out.
The reeds close by will also vibrate but to a lesser extent. (5)
[10]

2.3 EFFICIENCY = P OUTPUT / P INPUT x 100%

INPUT = OUTPUT / EFFICIENCY x 100% (1)
= 125 000 / 0,85 (1)
= 147 058,823 W (1)
Pin = $\sqrt{3} \times V_L \times I_L \times \cos \emptyset$ (1)
IL = Pin / $\sqrt{3} \times V_L \times \text{Cos} \emptyset$ (1)
= 147 000 / 1,732 x 380 x 0,9 (2)
= 248,258 A (1)
[8]

2.4 In star $V_L = \sqrt{3} \times V_P$ (1)
$= V_L / \sqrt{3}$ (1)
$= 380 / \sqrt{3}$ (1)
= 219,39 V (1)
$I_L = I_P = 25A$ (1)



Star connection (5)

[10]

2.5 $Pin = \sqrt{3} \times V_L \times I_L \times COS\emptyset$ (1)

$= \sqrt{3} \times 380 \times 25 \times 0,86$ (1)

$= 14\ 150,855$ W (1)

$= 14,150$ kW **[3]**

[40]

QUESTION 3

3.1 The voltage ratios must be the same. (2)

The primary as well as the secondary connections must be the same. (2)

They must be designed for the same frequency. (2)

The relation between reactance and resistance should fall within the same limits. (2)

[8]

3.2.1 $P_S = V_L \times I_L$ (1)

$I_L = P_S / V_L$ V_S = Supply Voltage (1)

$= 120\ 000 / 2\ 000$ (1)

$= 60$ A (1)

3.2.2 $P_S = V_{L2} \times I_{L2}$ (1)

$I_{L2} = S / V_{L2}$ (1)

$= 120\ 000 / 380$ (1)

$= 315,79$ A (1)

OR

$V_P/V_S = I_S / I_P$ (1)

$I_S = 2\ 000 \times 60 / 380$ (2)

$I_S = 315,79$ A (1)

(NOTE: $I_{L2} = I_S = 315,79$ A)

3.2.3 $V_P / V_S = N_P / N_S$ (1)

$N_P = V_P \times N_S / V_P$ (1)

$= 2\,000 \times 150 / 380$ (1)

$= 789{,}47$ turns (1)

[12]

3.3 $P_S = V \times I$ (1)

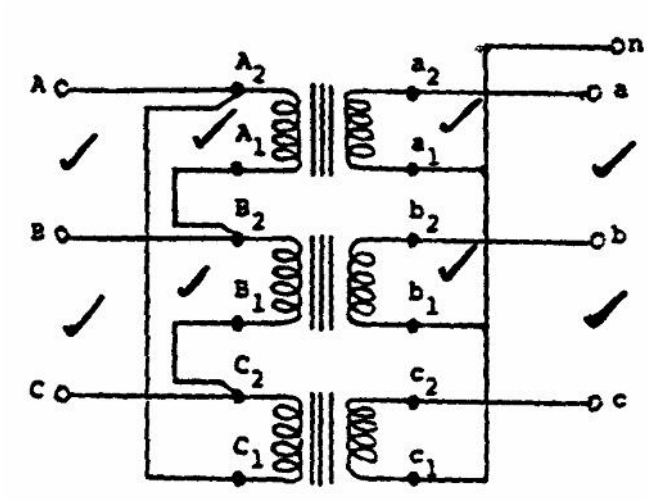
$I = P_S / V$ P_S = Skyndrywing = VA Apparent power (1)

$= 250\,000 / 7\,000$ (1)

$= 35{,}71$ A (1)

[4]

3.4



Supply **Load**

[8]

3.5 Its purpose is to dry the air which passes into the transformer tank when the air above the tank contracts, thus preventing moisture from entering the transformer. **[3]**

[35]

QUESTION 4

4.1 The speed of rotation of the magnetic flux is called synchronous speed. (2)

The speed that the Rotor rotates is called the Rotor speed and is always less than the synchronous speed. (2)

[4]

4.2 True speed $= \frac{F}{p}(1-5)$ (1)

$= \frac{50}{3}$ (1-8%) (1)

= 16,667 (1-0,08) (1)

= 16,667 (0,92) (1)

= 15,33 rev. per sec (1)

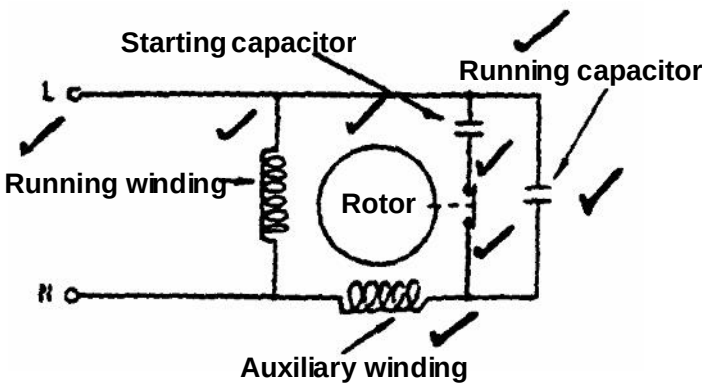
= 15,33 x 60 (1)

= 920 omwentelings per min. (1)

[Explanation: $S = \frac{ns - nr}{ns}$ and $ns = \frac{f \times 60}{p}$ and p = pole pairs, i.e. (3)

[7]

4.3



CAPACITOR START-AND-RUN MOTOR **[8]**

4.4 Frequency (1)

No of pole pairs (1)

[2]

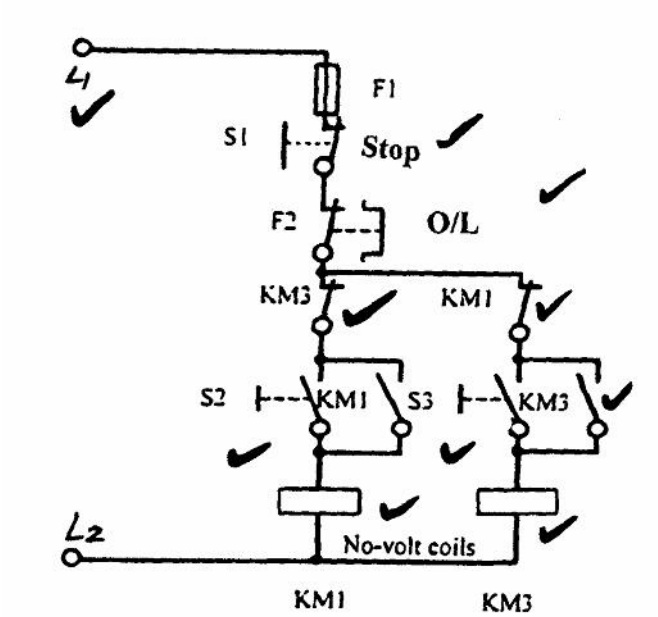
4.5 To switch or activate the main contact. (2)

AND

For safety purposes (cannot restart automatically). (2)

[4]

4.6



FOR WARD-REVE RSE-STARTER CONTROL CIRCUIT **[10]**

[35]

QUESTION 5

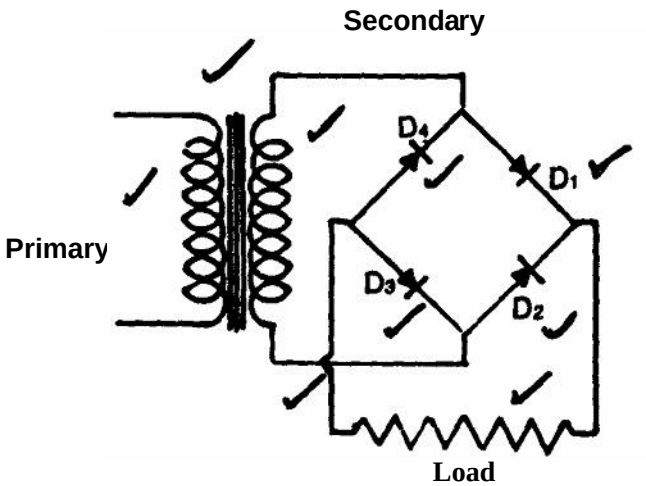
5.1

1. Both cur rent and vo ltage are amp lified and ther efore this can be regarded as a po wer amp lifier.

2. The output signal is inverted with respect to the input signal.

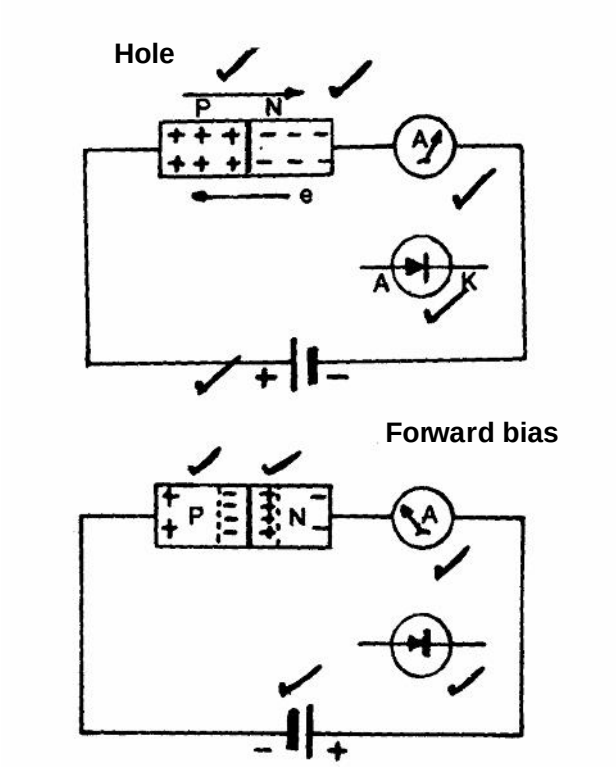
3. The input and output i mpeda nce are in the med ium range i.e. between approximate ly 1,5 and 5 kilo-ohms. **[6]**

5.2



[9]

5.3



[10]

5.4 1. Switch off the power supply. (1)

2. If the supply cannot be switched off the person must be pulled away using an insulated material. (1)

3. If necessary the conductors must be cut with pliers or hexed off with an axe. (1)

4. Ensure that you do not get shocked as well. (1)

5. Examine the person and if necessary you can perform basic treatment or have a doctor called. (1)

[5]

[30]

TOTAL: 200