education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

ELECTRICAL TECHNOLOGY

EXEMPLAR 2007

MEMORANDUM

This memorandum consists of 11 pages.

QUESTION 1

1.1 Yes, you do.√ You must take every precaution to protect yourself from comming into contact with another persons blood.√ Wear protective clothes while assisting any bleeding person,√ If this is not possible you still have a responsibility to report the incident and get immediate help√ (4)
(MANY EXAMPLES)

1.2 Cell phone√ (1)

Positive: Instant contact with family in time of need√ (1)

Negative: Exposure to undesirable material on phone√ (1)

1.3
- Communication skills√
- Time management skills√
- Financial skills√

(3)

QUESTION 2

2.1 Design and build an electronic warning sign to alert the traffic about cyclists and athletes.√ (4)

2.2
- the devise should flash colourful lights visible to the motorists√
- the devise should be portable. √
- the devise should use portable DC power supply, e.g battery√
- *the devise should be made of cheap material to make it cost effective*√
- the devise should be safe to use, i.e not subject to explosion√
- it should be easy to use√
- it should be easily maintained √

} Any three

(6)

QUESTION 3

3.1.1 Condition√ (1)

3.1.2 Act√ (1)

3.1.3 Act√ (1)

3.1.4 Condition√ (1)

3.2.1 Fire hose√ (1)

3.2.2 Location√ (1)

3.2.3 Fire extinguisher√ (1)

3.2.4 Grinder with guard√ (1)

3.3 A place for everything and everything in its place√√ (2)

QUESTION 4

4.1 Vertical: 10 V/div
Horizontal: 2.5 ms/div

Emax = 40 div√
= 4 div X 10 V/div√
= 40 V √ (3)

4.2 E_{rms} = 0.707 E_{max}√
= 0.707 X 40
= 28.28 V√ (2)

4.3 T = 8 div√
= 8 X 2.5 10^{-3}√
= 20 ms√ (3)

4.4 F = 1/T√
= 1/20 X10^{-3}√
= 50 Hz√√ (4)
[10]

QUESTION 5

5.1 As the conductor loop is rotated through the magnetic field, each of the two sides of the loop move through the magnetic field cutting the magnetic lines of flux.√
This action induces an alternating voltage across the conductor loop. The induced voltage varies in size and direction.√√ (3)

5.2.1 I_{max} = 12 A
= 314

I_{rms} = 0.707 I_{max}
= 0.707 X 12
= 8.48 A (2)

5.2.2 *i* = 12 sin 2πFt√
= 12 sin(314 X 1.5 X 10^{-3}) √
= 5.45 A√ (4)

.

(4)

5.3 At A

2 + 3 = I_3 √
I_3 = 5 A √

At B

$I_3 + I_2$ = 10
I_2 = 10 – I_3√
= 10 – 5
= 5 A √ (2)

At C

$I_1 = 2 + I_2$√

$= 2 + 5$

$= 7$ A√ (6)

[15]

QUESTION 6

6.1 Impedance of an RLC circuit is the total opposition the circuit offers to the flow current.√√ It is dependent upon the frequency of the supply.√ When connected across an alternating voltage supply. √ (4)

6.2.1 $X_L = 2\pi FL$√

$= 2 \times \pi \times 50 \times 75 \times 10^{-3}$√

$= 23.56\ \Omega$√

$X_C = 1/(2\pi FC)$ √

$= 1/(2 \times \pi \times 50 \times 220 \times 10^{-6})$ √

$= 14.47\ \Omega$√

$Z = \sqrt{R^2 + (XL - XC)^2}$√

$= \sqrt{22^2 + (23.56 - 14.47)^2}$√

$= 23.8\ \Omega$√

(9)

6.2.2 $I_S = V_S/Z$√

$= 110/23.8$√

$= 4.62$ A√ (3)

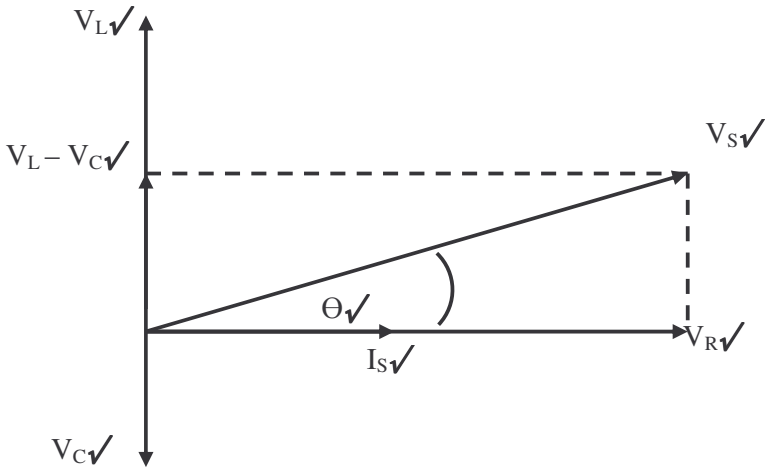
6.2.3 $\Theta = \cos^{-1} R/Z$√

$= \cos^{-1} 22/23.8$√

$= 22.43^\circ$√

(3)

6.2.4



(7)

6.3 Connect an ammeter in series in an RLC circuit√. Adjust the frequency √of the supply until the reading on the ammeter is reading√ a maximum current. The circuit will now be a resonat frequency. √ (4)

[30]

QUESTION 7

7.1
1. Collector√
2. Emmitter√
3. Base√
4. I_E√
5. I_D√
6. V_{CE}√ (6 x 0.5)= (3)

The voltage across the base emmitter junction√ must be high enough to forward bias the junction√ which will switch the transistor on and an emmitter current will flow. √ (3)

7.2 When forward biased, that is a positive potential on the anode√, the thyristor does not conduct until a positive potential is applied to the gate√. The thyristor will now conduct √even if the gate potential is removed and will continue to conduct until the supply voltage is removed or reversed. √ (4)

[10]

QUESTION 8

8.1 Biasing of a transistor is the enabling or switching on of the device in order for it to be able to amplify without causing crossover distortion and deformation of the input signal, thus giving a true reflection on the output of the circuit of the signal that was applied to the input of the circuit. It will be accepted if the learner only indicates that biasing switches the transistor on. √ (1)

8.2 As the input signal increases, so the internal resistance of the transistor decreases√ as it becomes more conductive√. The resulting effect is that the output voltage Vce will decrease in accordance, thus resulting in a negative output wave for a positive input. √ (6)

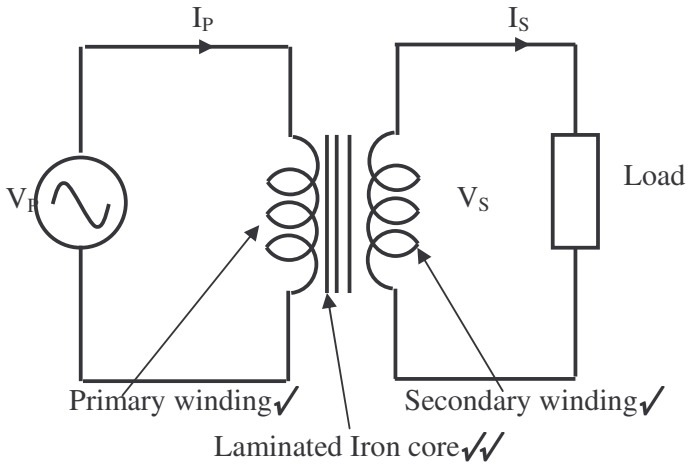
As the input on the base decreases, the internal resistance of the transistor increases√ and Vce will increase accordingly√. The result is that the output wave of the transistor increases as the input wave decreases√. The difference in size is between input and output is related to the gain of the transistor.

8.3 The Q-point is the idling point / working point√ from which the current flowing through the transistor will deviate when an input signal is applied at the base of the transistor. (1)

8.4 The calculated values of the resistors are critical in order for the transistor to operate within its parameters or abilities. If the values of the resistors are to high or too low it could result in distortion√ of the signal or overheating due to excess current√. It could even destroy the transistor in the process. (2)

QUESTION 9

9.1



(4)

9.2.1 The transformer may be overloaded √√ (2)

9.2.2 Oil√
Air√
Water√ (3)

9.2.3 $I_P = S/V_P$√
$= 1100 \times 10^3$√
$= 100$ A√ (3)

9.2.4 $I_S = I_P V_P/V_S$√
$= 100 \times 11000/230$√
$= 4782.61$ A√ (3)
[15]

QUESTION 10

10.1

10.1.1 Transforms the mains power from a high AC Voltage to a lower AC voltage in this instance. √ (1)

10.1.2 Rectifier - Rectifies the AC voltage to produce a pulsating DC voltage. √ This is achieved due to the diode only allowing current to flow in a single direction through it. (1)

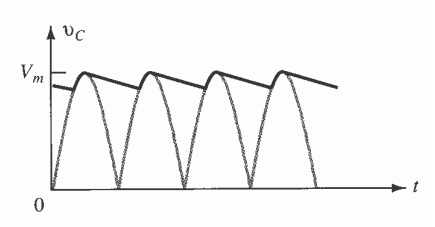
10.2 Ripple voltage √- this causes hum on power supplies, that could be transferred to the circuits that are supplied. (1)

10.3

10.3.1 (2)

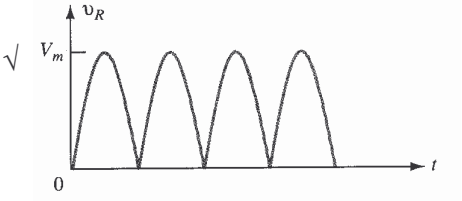
√

√



10.3.2 (1)

√



10.3.3 No. √ There is no controlling device / regulator√ in the circuit, and therefore it is not a regulated circuit. (2)

10.4

10.4.1 (2)

$$V_o = V_Z - V_{BE} = 12\text{ V} - 0.7\text{ V} = \mathbf{11.3\text{ V}}$$

√
√

10.4.2 (5)

$$V_{CE} = V_i - V_o = 20\text{ V} - 11.3\text{ V} = 8.7\text{ V}$$

√√

$$I_R = \frac{20\text{ V} - 12\text{ V}}{220\ \Omega} = \frac{8\text{ V}}{220\ \Omega} = 36.4\text{ mA}$$

√√
√

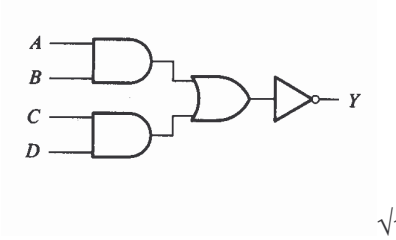
[15]

QUESTION 11

11.1 (5)

X = (AB) √+√ (BCD) √+√ (EFGH) √

11.2 (4)



√√√√

11.3 (8)

A	B	C	B+C	A.(B+C)	X	
0	**0**	**0**	**0**	**0**	1	√
0	**0**	**1**	**1**	**0**	1	
0	**1**	**0**	**1**	**0**	1	√
0	**1**	**1**	**1**	**0**	1	
1	**0**	**0**	**0**	**0**	1	√
1	**0**	**1**	**1**	**1**	0	
1	**1**	**0**	**1**	**1**	0	√
1	**1**	**1**	**1**	**1**	0	

$$X = \overline{A.(B+C)}$$ √√√√

11.4 The clock pulse will coordinate or synchronize the actions of the logic circuit, if it is a clocked or synchronous circuit. √ (1)

11.5 NAND Gate√ (2)

[20]

QUESTION 12

12.1.1 The function of an earth-leakage relay unit is to automatically disconnect an installation or circuit from the supply in the event of a leakage of 20 mA or more flowing to earth; (3)

12.1.2 The function of a circuit-breaker is to automatically open a circuit under abnormal conditions such as those of overload (3)

12.2 Advantages of a circuit-breaker compared to that of a fuse.

- in the event of an overload or fault, all poles of the circuit are positively disconnected.
- the devices are also capable of remote control by push-buttons, by under-voltage release coils, or by earth-leakage relay trip coils. (2)
- the overcurrent setting of the circuit breakers can be adjusted to suit the load conditions of the circuit to be controlled
- time-delay devices can also be installed to delay the time taken for tripping**(any two**)

12.3 A fuse is a protective device that contain a piece of base-metal wire between two terminals on a suitable support. most present-day applications require cartridge fuses, which are made of fusible elements contained rigid tubes filled with suitable exothermal and arc-quenching powders.

The fuse is therefore used for:

- allowing current during normal conditions in the circuit

interrupting overcurrents during fault conditions (2)
[10]

QUESTION 13
OPERATING PRINCIPLE OF SINGLE-PHASE MOTORS

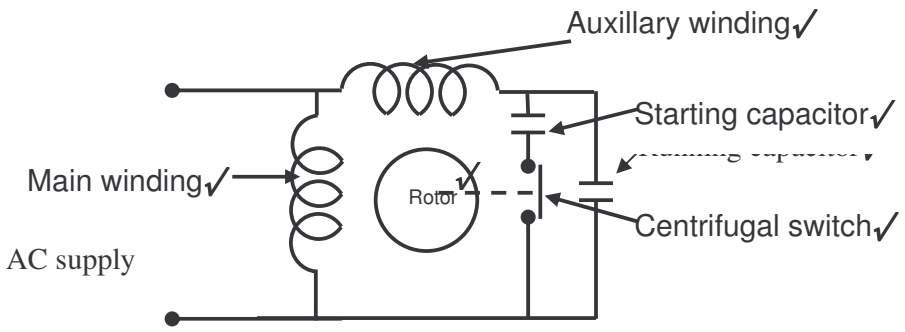
13.1 Sinlgle phase capacitor start motor√ (1)

13.2 Starting the motor by increasing the statrting torque √√
(It increases the phase shift between the currents in the starting winding and the running winding which creates the two phase effect necessary for starting) (2)

13.3
- A fault in the capacitor√√
- The capacitor and the starting windingng not connected together (Open circuit between the two√√
- Fault in the starting winding√√ ***(Any one)*** (2)

13.4 It disconnect the starting circuit when the motor approches 70% of its running speed√√ (2)

13.5



(6)

13.6.1 Interchange the connection to the field windings or the armature√√ (2)

13.6.2 Interchange the connections to either the starting winding or the running winding√√ (2)

13.7 Rotor speed is the actual speed of the motor. √√
Synchronous speed is the speed at which the rotating magnetic field rotate√√ (4)

13.8.1 Driving drills , elctri fans and other small appliances√√ (2)

13.8.2 Refrigirators, compressors,Lawn mowers etc. √√ (2)
[15]

QUESTION 14
COMMUNICATION SYSTEMS

14.1 Demodulation√ (1)

14.2 The capacitor is acting as a filter, removing the RF and producing an audio signal on the output. √ (1)

14.3 F1 = 10,7 MHz + 3,7 MHz = 14,4 MHz (2)
F2 = 10,7 MHz - 3,7 MHz = 5,6 MHz

Mixers produce an output that equals the sum of the input signals as well as the difference between the input signals. √√

14.4 The demodulation stage in a FM receiver is called the Discriminator. √ (1)

14.5 The nature of sky wave propagation is that the radio signal is reflected off the ionosphere and as a result stations at certain points away from the transmitting station will have very poor or no reception of that particular signal. The advantage of sky wave propagation is that it is about 90% reliable and long distance or DX communications is possible. √√ (2)

14.6 **Television signals are at times reflected of alternate structures close to the receiving antenna, causing the receiver to decode two signals that are slightly out of phase due to the delay of the reflection. This causes the delayed signal to be portrayed as a ghost picture.** √ (2)

This could be overcome by slightly changing the orientation of the receiving antenna in relation to the transmitter / transponder through lifting or lowering or changing the position of installation. √

14.7 **Yes.** √ (1)

[10]

TOTAL **[200]**

END / EINDE