Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2018

ELECTRICAL TECHNOLOGY: ELECTRONICS

MARKS: **200**

TIME: **3 hours**

IELTTE2

This question paper consists of 11 pages, including a formula sheet.

INSTRUCTIONS AND INFORMATION

1. The question paper consists of NINE questions.
2. Answer ALL the questions.
3. Sketches and diagrams must be large, neat and fully labelled.
4. ALL calculations must be shown, and correctly rounded off to TWO decimal places.
5. Answers must be numbered correctly according to the numbering system used in this question paper.
6. You may use a non-programmable calculator.
7. Show the units for ALL answers of calculations.
8. A formula sheet is provided at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1: OCCUPATIONAL HEALTH AND SAFETY

1.1 Describe the term regulation with regard to OHS. (2)

1.2 State TWO unsafe conditions that must be avoided in a workshop. (2)

1.3 Give ONE unsafe act in a school workshop that can cause an accident. (1)

1.4 State ONE procedure that must be followed when assisting an injured person. (1)
[6]

QUESTION 2: TOOLS AND MEASURING INSTRUMENTS

2.1 State TWO applications of an oscilloscope. (2)

2.2 Explain the operation of a line tester. (2)

2.3 Name ONE application of a Jigsaw. (1)

2.4 Describe the function of a crimping tool. (1)
[6]

QUESTION 3: WAVE FORMS

3.1 Name the TWO fields that combine to form a radio wave. (2)

3.2 Name ONE application of a radio wave. (1)

3.3 Design and label THREE different types of waveforms. (6)

3.4 Explain the term *rise time* with reference to a waveform. (2)

3.5 Refer to FIGURE 3.1 below and answer the questions that follow.

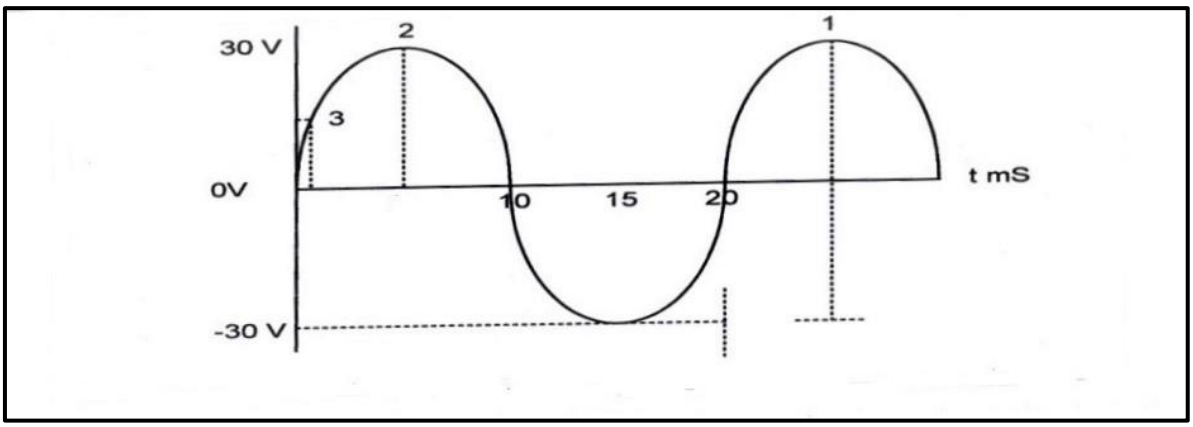

FIGURE 3.1

3.5.1 Identify labels **1**–**3**. (3)

Determine:

3.5.2 The period (1)

3.5.3 The peak to peak voltage (3)

3.5.4 The frequency (2)

3.5.5 The average value (3)

3.5.6 The RMS value (3)

[26]

QUESTION 4: RLC

4.1 Name TWO factors that influence the reactance of an inductor. (2)

4.2 Describe the term *impedance* in a RLC circuit. (2)

4.3 Draw the frequency/impendence characteristic curve of a series RLC circuit. The graph must show the relationship between reactance and the change in frequency, as well as the resonant frequency. (4)

4.4 List THREE conditions that occur during resonance. (3)

4.5 Refer to the circuit diagram in FIGURE 4.5.

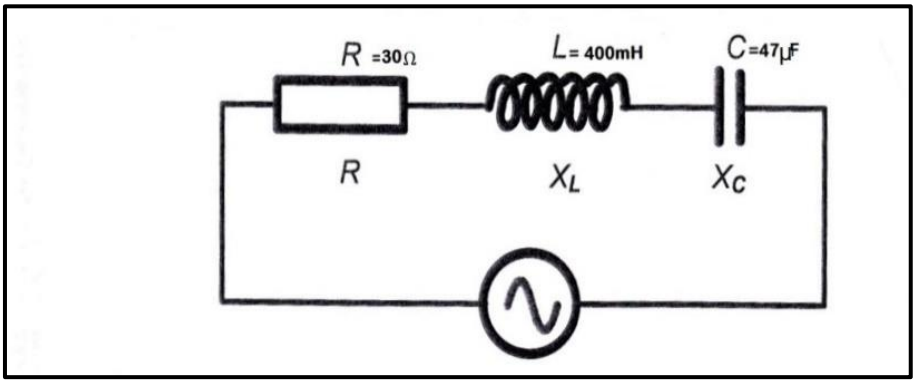

FIGURE 4.5: SERIES RLC CIRCUIT

Given: R = 30 Ω
L = 400 mH
C = 47 µF
f =50 Hz

Calculate:

4.5.1 The inductive reactance of the coil. (3)

4.5.2 The capacitive reactance of the capacitor. (3)

4.5.3 The impedance of the circuit. (3)

4.5.4 The resonant frequency. (3)

4.6 Explain the relationship between X_L and the frequency above resonant frequency. (3)

[26]

QUESTION 5: SEMICONDUCTOR DEVICES

5.1 Explain the term *semiconductor*. (2)

5.2 Name TWO impurities which can be added to pure silicon to create P-type material. (2)

5.3 For the normal operation of a transistor, which junction always needs to be:

5.3.1 Forward biased (2)

5.3.2 Reverse biased (2)

5.4 Draw the circuit symbols for the following:

5.4.1 SCR (3)

5.4.2 TRIAC (3)

5.4.3 Draw a fully labelled characteristic curve of a TRIAC (6)

5.5 Explain TWO ways to turn an SCR OFF. (4)

5.6

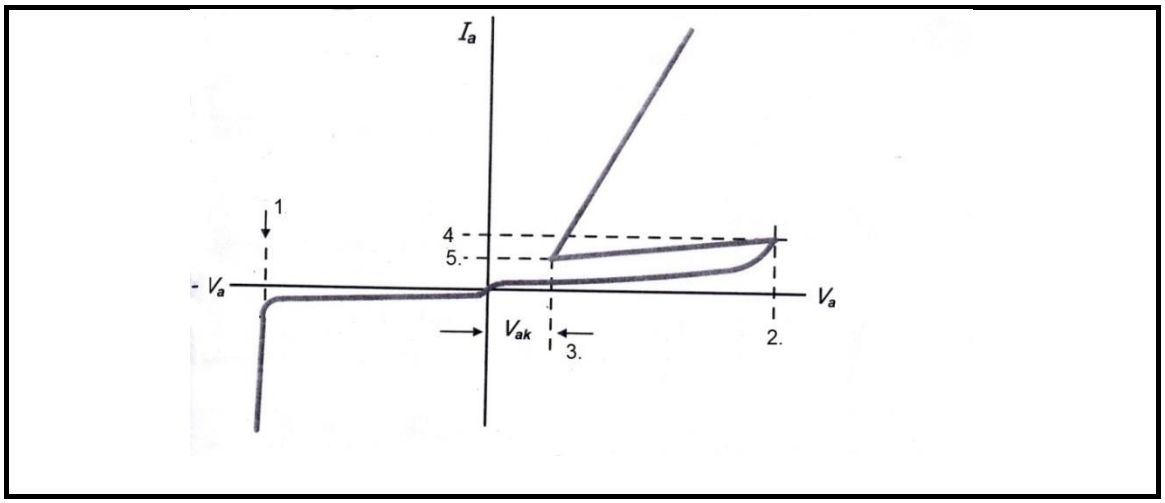

FIGURE 5.1

5.6.1 Identify labels **1**–**5**. (5)

5.7 Explain TWO disadvantages of a SCR. (4)

5.8 Draw the characteristic curve of a silicon diode, and explain how it operates. (10)

5.9 Explain the purpose of a DIAC. (2)

5.10 Explain the term *Q point*. (1)

[46]

QUESTION 6: POWER SUPPLIES

6.1 Explain the main purpose of a transformer. (2)

6.2 Draw the block diagram and waveforms showing the four stages of a power supply circuit with each stage clearly labelled and showing a simple circuit symbol in each block. (8)

6.3 The centre tapped transformer used in a bi-phase full wave rectifier circuit produced 17.1 V_{rms} across each of its windings. If the diodes used in the circuit each have a forward junction voltage of 0,6 V and the circuit supplies a 200 Ω load.

Calculate the following:

6.3.1 Peak secondary voltage (3)

6.3.2 Peak load voltage (3)

6.3.3 Average voltage across the load (4)

[20]

QUESTION 7: AMPLIFIERS

7.1 Explain the term *amplifier* in your own words. (2)

7.2 State ONE use of a class AB amplifier. (1)

7.3 Describe how class C amplification is obtained. (2)

7.4 List THREE common types of transistor configurations. (3)

7.5 Give TWO types of biasing used in amplifier design. (2)

7.6 What are the main features of the following transistor configurations?

7.6.1 Common collector (1)

7.6.2 Common base (1)

7.6.3 Common emitter (1)

7.7 Refer to FIGURE 7.1 below and answer the questions that follow.

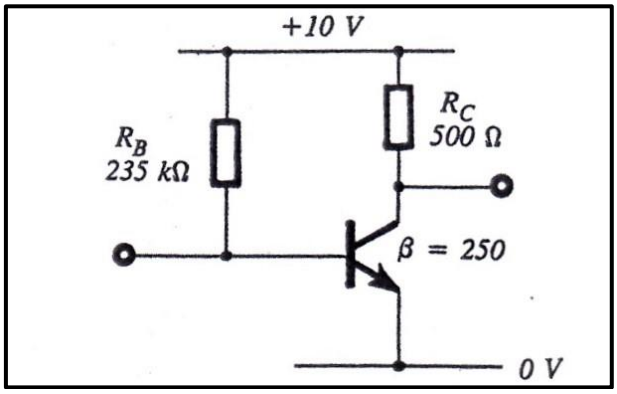

FIGURE 7.1

Calculate the:

7.7.1 Quiescent base current (3)

7.7.2 Quiescent collector current (3)

7.7.3 Quiescent collector-emitter voltage (3)

7.7.4 Plot the quiescent point (Q point) onto the transistor characteristic. (4)

7.8 Name TWO advantages of negative feedback. (2)

7.9 Draw and label a block diagram of negative feedback. (4)

[32]

QUESTION 8: SENSORS AND TRANSDUCERS

8.1 Explain the following:

8.1.1 A sensor (2)

8.1.2 Proximity sensors (2)

8.2 Name and describe the electrical effect that quartz crystal exhibits when it is put under pressure. (3)

8.3 Describe the main purpose of a temperature sensor. (2)

8.4 List THREE types of humidity sensors. (3)

[12]

QUESTION 9: COMMUNICATION SYSTEMS

9.1 Define the term *modulation*. (2)

9.2 List THREE types of common oscillators which rely on positive feedback. (3)

9.3 Explain the main role of a voltage controlled oscillator. (2)

9.4 Describe what *automatic frequency control* (OFC) is, when referring to receivers. (2)

9.5 Name TWO methods of radio modulation. (2)

9.6 Draw a clearly labelled block diagram of an FM radio transmitter. (5)

9.7 What does the term SSB stand for when referring to radio transmission? (1)

9.8 FIGURE 9.8 below shows the block diagram of a frequency modulation (FM) receiver.

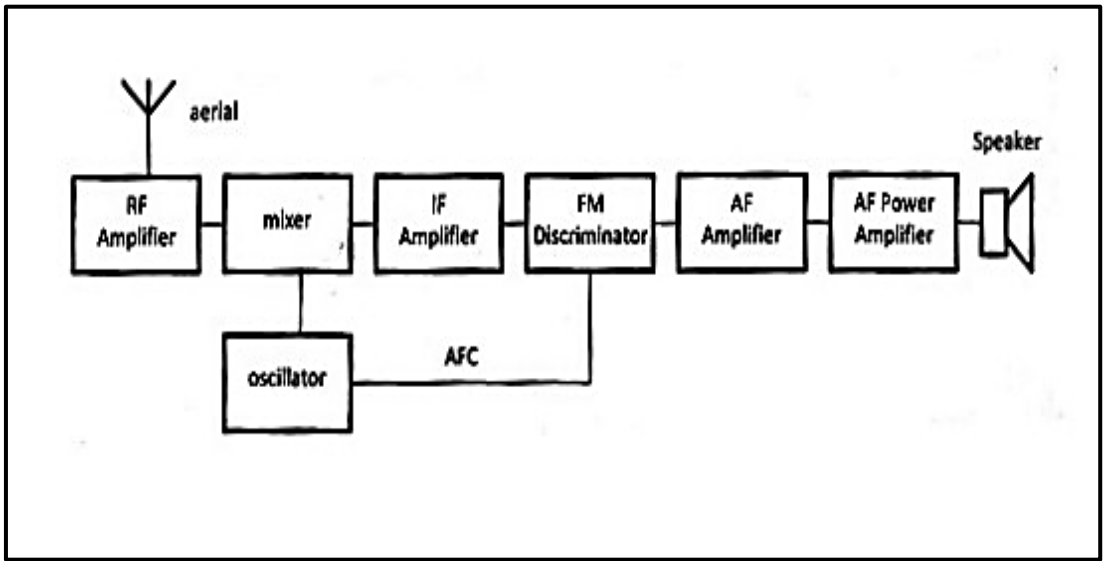

FIGURE 9.8

Explain the following terms:

9.8.1 RF Amplifier (2)

9.8.2 Oscillator (2)

9.8.3 Mixer (2)

9.8.4 FM Demodulator/Discriminator (3)

[26]

TOTAL: 200

ELECTRICAL TECHNOLOGY

FORMULA SHEET

WAVE FORMS

Frequency of rotation

$f = \frac{1}{T}$

$f = p \times n$

instantaneous value

$\omega = 2\pi f$

$\theta = \omega t$

$i = I_{MAX} \times Sin\ \theta$

$v = V_{MAX} \times Sin\ \theta$

Maximum value

$V_{MAX=}\ V_{RMS} \times 1{,}414\ (V)$

$V_{MAX} = 2\pi\beta AnN$

$E = BlV$

RLC CIRCUITS

Inductive reactance

$X_L = 2\pi f l$

Capacitive reactance

$X_C = \frac{1}{2\pi f c}$

Impedance

$z = \sqrt{R^2 + (X_L - X_C)^2}$

POWER

$P = V\ I\ COS\ \theta$

POWER FACTOR

$COS\ \theta = \frac{R}{Z}$

$COS\ \theta = \frac{VR}{VZ}$

WAVEFORMS

RMS Value

$V_{RMS} = V_{MAX} \times 0.707$

Average value

$V_{ave} = V_{max} \times 0.637$

AMPLIFIERS

$V_{CE\ max} = V_{VCC}$

$V_{CC} = V_{CE} + I_C R_C$

$I_B = \frac{V_{CC} - V_{CE}}{R_B}$

$I_C = \frac{V_{CC} - V_{CE}}{R_C}$

$I_C = \beta I_B$