This question paper consists of 5 pages, 2 diagram sheets and a 3-page formula sheet.
INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Keep sub-sections of questions together.
5. RULE OFF on completion of each question.
6. Use ONLY IEC symbols and units throughout.
7. ALL sketches must be neat, using a pencil and a ruler (NOT freehand).
8. NO red or green ink may be used.
9. Use \( \pi \) as 3,142 and NOT as \( \frac{22}{7} \).
10. Write neatly and legibly.
QUESTION 1
Define the following:

1.1 Forward bias
1.2 Free electrons
1.3 Kirchhoff's current law
1.4 An atom
1.5 Thermistor

(2) (2) (2) (2) (2)

QUESTION 2
Refer to FIGURE 1 (on attached DIAGRAM SHEET 1) and calculate the following:

2.1 The total resistance in the circuit
2.2 The total current flow
2.3 The current flowing through the 10 ohm resistor
2.4 The total power consumed by the circuit

(5) (2) (4) (2)

QUESTION 3

3.1 Briefly explain the term resonance.

(2)

3.2 A 15 Ω resistor, 30 mH inductor and a 15 μF capacitor are connected in series. The circuit is connected to a 100 V/50 Hz supply. Calculate the resonant frequency of the circuit.

(4)

3.3 Refer to FIGURE 2 (on attached DIAGRAM SHEET 1) and calculate the following:

3.3.1 The capacitive reactance
3.3.2 The total impedance of the circuit
3.3.3 The voltage across the resistor
3.3.4 The voltage across the capacitor

(2) (2) (2) (2)

[10] [13] [14]
QUESTION 4

Refer to FIGURE 3 (on attached DIAGRAM SHEET 2) and calculate the following:

4.1 The peak-to-peak value of the voltage (2)
4.2 The RMS and average value (4)
4.3 The frequency of the wave (2)
4.4 The form and crest factors (2)

[10]

QUESTION 5

5.1 Draw a neat, labelled characteristic curve of a 12 V zener-diode. (4)

5.2 Draw a fully labelled circuit diagram of a half wave rectifier, using a diode, transformer and a load resistor. Clearly show the input and output waveforms (7)

[11]

QUESTION 6

6.1 A moving coil meter has a full scale deflection of 20 mA and an internal resistance of 100 ohms. Calculate the value of the shunt resistor that would enable the meter to measure a current of 200 mA. Also draw a circuit to show where this resistor should be connected. (8)

6.2 State TWO precautions when using an amperemeter. (2)

[10]

QUESTION 7

7.1 Draw and label a circuit diagram of a common emitter amplifier. Make use of an NPN transistor and all relevant components. Clearly show the input and output waveforms. (8)

7.2 Name TWO classes of amplifiers. (2)

[10]
QUESTION 8

8.1 Refer to FIGURE 4 (on attached DIAGRAM SHEET 2) and calculate the following:

The output power of the amplifier

(5)

8.2 Briefly explain, with the aid of sketches, the construction and operation of the bi-metallic strip.

(6)

QUESTION 9

9.1 Briefly explain how the control between the transmitter and receiver is achieved.

(5)

9.2 Draw a neat sketch showing the coupling between a synchrotransmitter and an indicator to give a 240° phase shift.

(6)

TOTAL: 100
FIGURE 1

FIGURE 2
(xii) Crest factor = \( \frac{\text{Maximum value}}{\text{RMS value}} \)

Kruinfaktor = \( \frac{\text{Maximum waarde}}{\text{WGK-waarde}} \)

(xiii) \( \omega = 2\pi f \)

(xiv) \( X_C = \frac{1}{2\pi f C} \)

(xv) \( X_L = 2\pi f L \)

(xvi) \( V_T = \sqrt{V_R^2 + V_L^2} \)

(xvii) \( V_T = \sqrt{V_R^2 + V_C^2} \)

(xviii) \( V_T = \sqrt{V_R^2 + (V_L - V_C)^2} \)

(xix) \( Z = \sqrt{R^2 + X_C^2} \)

(xx) \( Z = \sqrt{R^2 + X_L^2} \)

(xxii) \( Z = \sqrt{R^2 + (X_L - X_C)^2} \)

(xxii) \( I_T = \frac{V_T}{Z} \)

(xxiii) \( V_C = I_T \times X_C \)

(xxiv) \( V_R = I_T \times R \)

(xxv) \( V_L = I_T \times X_L \)

(xxvi) \( \theta = \cos^{-1} \frac{R}{Z} \)

(xxvii) \( f_0 = \frac{1}{2\pi \sqrt{LC}} \)
MEASURING INSTRUMENTS/MEETINSTRUMENTEN

(i) \[ R_{SH} = \frac{I_M \times R_M}{I_{SH}} \]

(ii) \[ R_S = \frac{V_F}{I_M} - R_M \]

TRANSISTORS

(iii) \[ I_e = I_c + I_b \]

DECIBEL RATIOS/DESIBELVERHOUDINGS

(iv) \[ N = 10 \log \frac{P_0}{P_1} \]

(v) \[ N = 20 \log \frac{I_0}{I_1} + 10 \log \frac{R_0}{R_1} \]

(vi) \[ N = 20 \log \frac{V_0}{V_1} + 10 \log \frac{R_1}{R_0} \]

If/As \( R_1 = R_0 \)

(vii) \[ \text{then/dan } N = 20 \log \frac{I_0}{I_1} \]

(viii) \[ N = 20 \log \frac{V_0}{V_1} \]

(ix) RESISTANCE

\[ R = \frac{\rho \ell}{a} \]

(x) \[ a = \frac{\pi d^2}{4} \]