

PHYSICS Paper-B

(Electronics and Solid State Devices-I)

Time Allowed : Three Hours

Maximum Marks : 44

Note: Attempt any two questions each from Section-A and Section-B. Section-C is compulsory. The use of non-programmable calculator is allowed.

SECTION - A

1. (a) What is a cathode ray oscilloscope (CRO) ? Write down its principle, working and uses in detail. 6
- (b) Mention equivalence between the current and voltage sources. How current source can be converted in to voltage source ? 3

2. (a) Obtain an expression for the depletion width of $p-n$ junction diode? What happens to the width layer when the diode is forward or reverse biased? 6
- (b) Calculate the static and dynamic resistance of a Ge diode at room temperature (25°C). Given reverse saturation current (I_s) = $1\mu\text{A}$ and bias voltage (V) = 0.5 V . 3

3. (a) Show that at absolute zero temperature Fermi level of a semiconductor lies exactly at middle of the top of valence band and bottom of the conduction band. What happens to Fermi level when the temperature increases? 6
- (b) A minimum current of 3.2 mA passes through a Zener's diode having rating 14 V and 0.25 W . Then calculate the value of series resistance if it is connected with 12 V supply power supply. 3

SECTION – B

4. (a) What is a Rectifier? Draw the circuit diagram and explain working of full wave rectifier with Π -section filter. Also derive expression for the ripple factor. 6
- (b) Draw the input and output waveform through unbiased and biased series positive clippers. 3
5. (a) Define load line and quiescent point of a transistor amplifier. How will you draw load line on the output characteristics of a transistor and what is its importance? 6
- (b) In a common base circuit, $\alpha = 0.96$. If the base current is $60\mu\text{A}$, then calculate (i) emitter and (ii) collector current through transistor. 3
6. (a) Draw a neat diagram of common emitter transistor amplifier and its a.c. equivalent circuit. Obtain the expression for current gain, voltage gain, power gain, input resistance and output resistance in term of h -parameters for this configuration. 7
- (b) Define, early effect, in the input characteristic of common base transistor. 2

SECTION – C

7. Attempt any eight parts :

- (i) Why the resistance of $p-n$ junction diode decreases when it is forward biased?
- (ii) Define knee voltage. What is the value of knee voltage for Si and Ge diode?

- (iii) Tell why the base region of a transistor is very thin as compare to emitter and collector region ?
- (iv) What are photo diodes ?
- (v) Differentiate between ordinary and light emitting diode.
- (vi) Why Zener breakdown voltage decrease with increase in temperature ?
- (vii) Define ripple factor of rectifier.
- (viii) Why do we prefer to use transistor amplifier in CE mode ?
- (ix) A bipolar junction transistor has $I_B = 400 \mu\text{A}$, $\beta = 99$, $I_{co} = 2 \mu\text{A}$. Calculate its collector current.
- (x) Define peak inverse voltage and leakage current. 1×8=8