## 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.

(b) Mention equivalence between the current and voltage sources.

How converted in to voltage source?

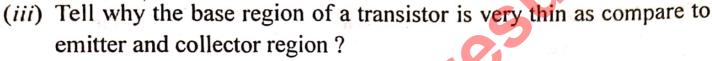
- 2. (a) Obtain an expression for the depletion width of p-n junction diode? What happens to the width layer when the diode is forward or reverse biased?
  (b) Calculate the static and dynamic resistance of a Ge diode at room temperature (25°C). Given reverse saturation current (I<sub>s</sub>) = 1 μA and bias voltage (V) = 0.5 V.
- 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?
  - (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 supple power supply.

#### 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.
  - (b) Draw the input and output waveform through unbiased and biased series positive clippers.
- 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?
  - (b) In a common base circuit,  $\alpha = 0.96$ . If the base current is 60  $\mu$ A, then calculate (i) emitter and (ii) collector current through transistor.
- 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.
  - (b) Define, early effect, in the input characteristic of common base transistor.

#### SECTION-C

- 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?



- (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  $I_B = 400 \mu A$ ,  $\beta = 99$ ,  $I_{co} = 2 \mu A$ . Calculate its collector current.
      - (x) Define peak inverse voltage and leakage current.