

2056
Bachelor of Science (FYUP)-Fourth Semester
Physics
Paper: Electronics & Solid State Devices - I

Time allowed: 3 Hours

Max. Marks: 60

NOTE: Attempt five questions in all, including Question No. 7 (Unit-III) which is compulsory and selecting one question each from Unit I - II. Use of a non-programmable calculator is allowed.

x-x-x

UNIT - I

1. (a) Draw the block diagram of Cathode Ray Tube (CRT). What is the function of aquadag coating necessary in CRT? Draw the pattern observed on the screen of the cathode ray oscilloscope, when the phase difference between two signals of the same frequency is (i) $\frac{3\pi}{4}$ (ii) π .

(b) State Thevenin Theorem. Explain with an example. (8,4)
2. (a) Show that at absolute zero temperature Fermi level of a semiconductor lies exactly at the middle of the top of the valence band and the bottom of the conduction band. What happens to the Fermi level, when the temperature increases?

(b) Discuss the flow of current qualitatively in forward biasing in a diode. (8,4)
3. (a) Explain the principle and working of a light-emitting diode (LED). Write any two applications of LED. Explain why we prefer LED over conventional incandescent lamps.

(b) Find the static and dynamic resistance of a p-n germanium junction for an applied bias of 0.6 V at 300 K. Given $I_s = 1.2 \mu A$, $k = 1.38 \times 10^{-23} \text{ JK}^{-1}$ (8,4)

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(2)

UNIT - II

4. (a) Draw the circuit diagram of the LC filter with a full-wave rectifier. Explain the working. Also, derive the expression for its ripple factor.
- (b) What are clipping circuits? Discuss the different types of clipper circuits. (8,4)
5. (a) What is a transistor? Draw the input and output characteristics of a common emitter p-n-p transistor amplifier. Explain active, saturation and cut-off regions.
- (b) Draw the circuit diagram of the Zener diode used as a voltage stabilizer and explain how it works. (8,4)
6. (a) What do you understand by transistor biasing? Mention the factors that affect the bias stability of a transistor. Draw a collector to base bias circuit diagram and derive an expression for its stability factor.
- (b) For a transistor at the quiescent operating point, the collector current $I_c = 5.202 \text{ mA}$, reverse saturation current $I_{CO} = 2 \mu\text{A}$ and base current $I_B = 50 \mu\text{A}$. Determine the values α , β and emitter current. (8,4)

UNIT - III

7. Attempt any six questions:

- a) Does the operating point of the transistor amplifier shift with temperature?
- b) Difference between transition and diffusion capacitance?
- c) What is the advantage of a bridge rectifier over a conventional full-wave rectifier?
- d) What is the donor concentration in n-type Ge of $10^{-2} \Omega \text{ m}$ resistivity at 300 K? Given $\mu_e = 0.39 \text{ m}^2 \text{V}^{-1} \text{s}^{-1}$.
- e) Why is the capacitor filter preferred to the inductor filter?
- f) What is the function of the sweep circuit?
- g) What is the knee voltage for Silicon and Germanium diode?
- h) What are direct and indirect semiconductors? Explain. (6x2)

x-x-x