

(i) Printed Pages : 4

Roll No.

(ii) Questions : 7

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Exam. Code :

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B.A./B.Sc. (General) 5th Semester

(2125)

PHYSICS

Paper-B : Electronics and Solid State Devices-I

Time Allowed : Three Hours]

[Maximum Marks : 44

Note :— Attempt FIVE questions in all, selecting TWO questions each from Units I and II. Unit-III is compulsory. Use of non-programmable calculator is allowed.

UNIT—I

- (a) Explain the principle and working of Cathode Ray Oscilloscope (CRO) using a proper block diagram. How can we measure the phase difference between two AC signals using CRO?
- (b) An optical fibre containing 6×10^6 photons is incident on a photodiode and 4.5×10^6 electron-hole pairs are created. Then calculate the maximum possible quantum efficiency (in %) of the photodiode. 6,3

2. (a) What is a Zener diode? Write down its characteristics. Distinguish between avalanche and Zener breakdown mechanisms. How can a Zener diode be used to stabilize the voltages?
- (b) State and prove Norton's theorem with suitable diagrams. 6,3
3. (a) Obtain the expression for the width of the depletion layer for a p-n junction diode. What happens to the width when it is forward or reverse biased? Also derive the expression for junction capacitance.
- (b) A p-n junction Si diode is given a forward bias of 0.5 V. Determine the value of static and dynamic resistances of the diode at 27°C if the reverse saturation current is 1 μ A. 7,2

UNIT—II

4. (a) Describe the working of a full-wave rectifier with an inductor filter. Obtain the expression for ripple factor.
- (b) Calculate the efficiency of a half-wave rectifier fed with sinusoidal voltage of 50 V and frequency 50 Hz. The load resistance of the rectifier are $R_L = 250\Omega$ and $R_f = 250\Omega$. 7,2

5. (a) Explain the input and output characteristics of an n-p-n transistor in common base configuration. What are the active, cut-off, saturation, and breakdown regions in the output characteristic?
- (b) What are Amplifiers? Discuss class A, B, and C type amplifiers. 6,3
6. (a) What are the load line and Q-point of a transistor amplifier? Why is the Q-point generally preferred in the middle of the active region? Explain graphically the operation of a transistor as an amplifier.
- (b) For a single-stage amplifier, input resistance $R_i = 5 \text{ k}\Omega$ and collector load resistance $R_D = 10 \text{ k}\Omega$. Calculate the voltage and power gain of the amplifier if the current gain is 60. 6,3

UNIT—III

7. Attempt any **eight** parts:
- How can we convert a voltage source into a current source?
 - Why are LEDs superior to conventional incandescent bulbs?
 - What happens to the Fermi level of an extrinsic semiconductor with an increase in dopant impurities?
 - Calculate the value of β parameter if $\alpha = 0.99$.

- v. Define threshold voltage. What is its value for a Si diode?
- vi. What is the effect of temperature on the conductivity of semiconductor and conductor?
- vii. Which filter has greater voltage output, an inductor filter or a capacitor filter?
- viii. Define the stability factor of a transistor.
- ix. What is peak inverse voltage?
- x. Why is the base region of a transistor thin relative to the emitter and collector region? 1×8=8