B. Sc. Physics Examination, 2025

(2nd Year, 1st Semester)

(Basic Electronics)

Time : 2 *hours* *Full Marks* : 40

Answer **one** question from each **CO**.

CO-1

1. *(a)* What is a p-n junction diode?

(b) How does a barrier field appear across a p-n junction?

(c) What is the difference between an ordinary semiconductor diode and a Zener diode?

(d) The reverse saturation current at 300 K of a p-n junction germanium diode is 5 μA. Find the voltage to be applied across the junction to obtain a forward current of 50 mA. (η = 1 for germanium) 2+3+2+3=10

2. *(a)* Draw the circuit diagram of a full wave rectifier. Also draw the waveforms of the voltage across the diode and the load resistance.

(b) What is Light Emitting Diode? Why is silicon not preferred as an LED material? (2+3)+(2+3)=10

CO-2

3. *(a)* Discuss the different current components in a transistor.

(b) Define transistor β (current gain). In a BJT Collector current (I_C) = 10 mA for base current (I_B) = 100 μA. Find the approximate value of β (current gain).

(c) What are the advantages of FET over BJT?

4+4+2=10

4. *(a)* When is the channel of a JFET said to be pinched off?

(b) Draw and explain for a *n* channel JFET *(i)* output characteristics curve and *(ii)* mutual characteristics curve.

(c) Define transconductance of a JFET. A *n*-channel JFET has I_{DSS} = 12 mA. If the transconductance g_m at V_{GS} = 0 is 4 millimho, find the pinch-off voltage.

2+4+4=10

CO-3

5. *(a)* How a non-inverting amplifier using OP-AMP can be modified as a voltage follower?

(b) Explain with circuit diagram that OP-AMP may be used as integrator.

(c) Sketch the output of the integrator if input is *(i)* sine wave and *(ii)* square wave. 4+4+2=10

6. *(a)* Write down the characteristics of an ideal OP-AMP.

(b) Show how an OP-AMP may be used as adder.

(c) Draw a circuit using one OP-AMP whose output v_o is given by $v_0 = 4v_1 + 6v_2$, where v_1 and v_2 are two input signals. 2+4+4=10

CO-4

7. *(a)* Convert the decimal number 22·875 to its binary equivalent and the binary number 110·011 to its decimal equivalent.

(b) Show that NAND gate is a universal gate.

(c) State and prove De Morgan's theorems. 2+3+5=10

8. *(a)* Design and explain the working of an AND gate with the help of diodes.

(b) Add the binary numbers 1110 and 101

(c) Simplify the expression $\overline{(A + \bar{B} + C) + (B + \bar{C})}$

6+2+2=10

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