Paper / Subject Code: N10552 / Elective : Semiconductor Physics

F.E. sem II (NEP-2020) All Branches Nov-2025 Date 09/12/2025

Q.P. 99069 ①/①

Time: (1and 1/2 Hours) **(Total Marks: 45)**

N.B. **1) Question No. 1 is compulsory.**
2) Answer any two questions from Q.2 to Q.5.
3) Figures to the right indicates full marks

1. Attempt any **Five**
   - (a) State three parameters of JFET. 3
   - (b) Explain construction and working principle of Photodiode. 3
   - (c) Calculate Emitter current of a transistor for which $\beta = 50$ and Base current is $20\mu A$. 3
   - (d) Explain the importance of surface to volume ratio in Nanomaterials. 3
   - (e) The resistivity of Cu is 1.72×10^{-8} ohm-m. Calculate the mobility of electrons in Cu. 3
     Given that : Number of electrons per unit volume is $10.41 \times 10^{28}/m^3$.
   - (f) Explain the formation of potential Barrier in a P-N junction with the help of neat diagram. 3
   - (g) Distinguish between FET and BJT (Minimum three points) 3

2. (a) What is Fermi level? Prove that the fermi level lies exactly in between conduction band and valance band of intrinsic semiconductor. 5
   - (b) Draw and explain I-V characteristic of P-N junction diode. 5
   - (c) Explain working of Solar cell. Write it's applications. 5

3. (a) Define amplification factor (β) in a common Emitter configuration of a transistor. Derive relation between α and β . Find equation for collector current. 5
   - (b) Explain MOSFET as switch. 5
   - (c) State principle of electron beam lithography and explain it's working. 5

4. (a) What is meant by LED? What materials are used to construct LED? Explain working of LED with I-V characteristics. 5
   - (b) Explain the working of NPN transistor with neat circuit diagram. 5
   - (c) A sample of n-type silicon has a donor density of $10^{20}/m^3$. It is used in Hall effect experiment. If the sample of thickness 4.5 mm is kept in a magnetic field of 0.55 T with current density of $500 A/m^2$. Find (i) Hall voltage developed in it,(ii) Hall coefficient, (iii) Hall angle if mobility of electron is $0.17\ m^2/V\text{-}s$ 5

5. (a) Explain the approaches used in synthesis of nanomaterials. 5
   - (b) Draw and explain I-V characteristic of Zener diode. What is meant by avalanche breakdown. 5
   - (c) Explain drain characteristic of JFET. When a reverse gate voltage of 15V is applied to JFET, gate current is $10^{-3}\ \mu A$. Find the resistance between gate and source. 5

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