

**017302****December 2023**

**B.Tech. (EEIOT/ENC) - IIIrd SEMESTER  
Semiconductor Devices (ECP-302)**

Time : 3 Hours]

[Max. Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

**PART-A**

1. (a) Explain the reason why the conductivity of germanium is more than that of silicon at room temperature. (1.5)
- (b) Can a P-N junction diode be used as a temperature sensor? (1.5)
- (c) What are the four modes of operation of BJT? (1.5)
- (d) What is pinch-off voltage? (1.5)
- (e) In a common base configuration,  $\alpha_{dc} = 0.95$ , the voltage drop across  $2.5 \text{ k}\Omega$  resistance which is connected in the collector is  $2.5\text{V}$ . Find the base current. (1.5)

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- (f) Why is Si preferred over Ge for IC fabrication? (1.5)
- (g) What are the merits of LEDs? (1.5)
- (h) What is positive and negative photo resists and where they are used? (1.5)
- (i) What is the voltage at the gate that sets the MOS structure at the onset of strong inversion called? (1.5)
- (j) Draw an NPN transistor in the CB configuration biased for operation in active region. (1.5)

### PART-B

2. (a) Find out the equation of continuity for the N-type semiconductor. Also explain the physical significance of each term. (7.5)
- (b) State and explain the characteristics of a zener diode. How it can be used as a voltage regulator? (7.5)
3. (a) What do you understand by etching? Differentiate between wet and dry etching. Explain, why the dry etching is considered better than chemical etching? (7.5)
- (b) With the aid of a diagram, explain the Ebers-Moll model. (7.5)
4. (a) Sketch typical CE output characteristic curves for an NPN transistor. Label all variables. Explain in brief how you will compute  $\beta$  of the transistor from these characteristic curves. (7.5)

- (b) A potential difference of 10V is applied longitudinally to a rectangular specimen of intrinsic germanium of length 25 mm, width 4 mm and thickness 1.5 mm. Determine at room temperature (i) electron and hole drift velocities (ii) the conductivity of intrinsic germanium if intrinsic carrier density is  $2.5 \times 10^{19} \text{ m}^{-3}$  and (iii) the total current. (7.5)

5. (a) Define and explain the parameters transconductance ( $g_m$ ), drain resistance ( $r_d$ ) and amplification factor ( $\mu$ ) of a JFET. Establish the relation between them. (7.5)
- (b) What is the principle of lithography? Explain the process of photolithography technique and its advantages. (7.5)
6. (a) What is the ideal Schottky barrier height? Indicate the schottky barrier height on an energy band diagram. Also compare the forward biased current-voltage characteristic of a schottky barrier diode to that of pn junction diode. (7.5)
- (b) Explain the depletion and enhancement type MOSFET with relevant diagrams. (7.5)
7. Write short notes on :
- (a) Sheet resistance.
- (b) Solar cell. (15)