

**008301****December 2023****B.Tech. (ECE) III SEMESTER****Electronic Devices (EC-301)**

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. Each question maximum marks is 15.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

**PART-A**

1. (a) Why extrinsic semiconductors are preferred for fabrications of devices? (1.5)
- (b) Write the equation for the net current in a semiconductor. What is the physical significance of each term? (1.5)
- (c) What type of capacitances associated with PN Junction Diodes? (1.5)
- (d) Find the location of Fermi energy level for intrinsic and extrinsic type of semiconductors. (1.5)

- (e) Compare the IV Characteristics of PN Junction diode for Ge and Si based diode. (1.5)
- (f) Plot the Common base transistor input and output characteristics for BJT. (1.5)
- (g) What is the input resistance of MOSFET? (1.5)
- (h) Define the term electrical base width. (1.5)
- (i) Explain upon what four parameters does the contact difference of potential depend? (1.5)
- (j) Compare the properties of Si and Ge material for various parameters in tabular form. (1.5)

### PART-B

2. What are the four advantages of Integrated circuits? And Explain the five basic processes involved in the fabrication of an integrated circuit (IC), assuming you already have a substrate. (15)
3. (a) Explain the breakdown mechanism in junction diodes in detail. (8)  
(b) Derive the Generalized transistor equations for PNP transistor. (7)
4. (a) A Ge sample is doped with phosphorus to the extent of 1 atom per  $10^8$  atoms. Assume that the effective mass of electron ( $m_n$ ) is half of its true mass. Find the location of Fermi level.  
Repeat part (a) if the doping is 1 per  $10^3$  atoms. (8)

- (b) How does the transition capacitance  $C_T$  vary with the depletion layer width? (7)  
(a) With the applied reverse voltage? (b) What is the order of magnitude of  $C_T$

5. (a) Discuss and plot the open circuited p-n Junction diode characteristics. (8)  
(b) Discuss and plot the p-n-p transistor characteristics in open circuited condition and in active mode of operation of the transistor. Diagrams must be properly sketched. (7)
6. Consider a step graded junction p-n junction with doping profile  $N_A > N_D$ . Then derive a mathematical relationship for charge density, field intensity and potential as a function of distance from the junction for reverse bias. (15)
7. Explain construction and working of n-channel enhancement type MOSFET in detail. Plot its small signal equivalent model when operating in saturation region. (15)