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## Third Semester B.E. Degree Examination, June/July 2023 Electronic Devices

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Explain direct and indirect semiconductors with neat sketches and giving examples. (06 Marks)
- b. Define:
  - i) Intrinsic semiconductor
  - ii) Amphoteric Impurity
  - iii) Electron mobility
  - iv) Hall Effect. (08 Marks)
- c. A silicon is doped with  $10^{17}$  Arsenic atoms/cm<sup>3</sup>. What is the equilibrium hole concentration  $p_0$  at 300°K? Sketch the resulting band diagram showing where is  $E_F$  relative to  $E_i$ . Assume  $n_i^2 = 2.25 \times 10^{20}$ . (06 Marks)

OR

- 2 a. Explain effects of temperature and doping on mobility. (08 Marks)
- b. Explain the formation of extrinsic semiconductor with covalent bonding model diagram. (06 Marks)
- c. Consider a semiconductor bar with  $W = 0.1\text{mm}$ ,  $t = 10\text{mm}$  and  $L = 5\text{mm}$ . For  $B_z = 10\text{kG}$  in the direction shown in Fig.Q.2(c) and a current of  $1\text{mA}$ ,  $V_{AB} = -2\text{mV}$ , and  $V_{CD} = 100\text{mV}$ . Find the type of semiconductor carriers and mobility of the majority carrier. Given  $1\text{KG} = 10^{-5}\text{wb/cm}^2$ . (06 Marks)

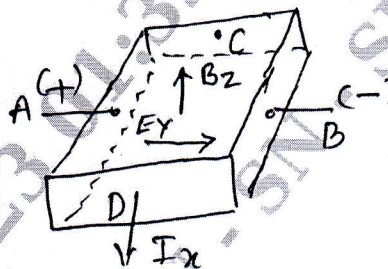


Fig.Q.2(c)

### Module-2

- 3 a. Differentiate Zener and Avalanche breakdown. (06 Marks)
- b. Explain the requirement for the design of rectifier diode. (06 Marks)
- c. Explain the working of solar cell and mention the applications of LED. (08 Marks)

OR

- 4 a. Mention the applications of photo diode. (06 Marks)
- b. Explain the current and voltage in an illuminated junction by deriving the expression for  $V_{oc}$ . (08 Marks)
- c. A solar cell has a short circuit current of  $100\text{mA}$ , and an open circuited voltage of  $0.8\text{V}$  under full solar illumination. What is the power delivered by the cell which is having a fill factor of  $0.77$ ? (06 Marks)

**Module-3**

- 5 a. Derive the relationship between  $\alpha$  and  $\beta$  of a transistor. (06 Marks)  
 b. Explain switching action of transistor. (08 Marks)  
 c. A symmetrical  $p^+np^-$  bipolar transistor has the following properties:

	Emitter	Base
$A = 10^{-4} \text{ cm}^2$	$N_a = 10^{17}$	$N_d = 10^{15} \text{ cm}^{-3}$
$W_b = 1 \mu\text{m}$	$t_n = 0.1 \mu\text{s}$	$t_p = 10 \mu\text{s}$
	$\mu_p = 200$	$\mu_n = 1300 \text{ cm}^2 \text{ v.s}$
	$\mu_n = 700$	$\mu_p = 450 \text{ cm}^2 \text{ v.s}$

Assume  $n_i = 1.5 \times 10^{10} / \text{cm}^3$ . Find base current. (06 Marks)

**OR**

- 6 a. Explain the working of pnp transistor with necessary figures. (08 Marks)  
 b. Explain BJT fabrication process. (06 Marks)  
 c. Explain drift in the base region. (06 Marks)

**Module-4**

- 7 a. Explain n-channel PNJFET operation with its characteristics. (10 Marks)  
 b. Mention the difference between JFET and MOSFET. (04 Marks)  
 c. Explain the MOS structure with aid of parallel plate capacitor. (06 Marks)

**OR**

- 8 a. Explain the operation of p-channel depletion and enhancement type MOSFET with neat sketches. (10 Marks)  
 b. Mention the applications of MOSFET. (04 Marks)  
 c. Draw and explain small signal equivalent circuit of a n-channel PNJFET. (06 Marks)

**Module-5**

- 9 a. Mention the advantages of IC's over discrete components. (06 Marks)  
 b. Explain photolithography process. (06 Marks)  
 c. Explain the working of CMOS inverter with neat diagram. (08 Marks)

**OR**

- 10 a. Explain thermal oxidation and diffusion process of the semiconductor fabrication. (08 Marks)  
 b. Explain integration of other circuit elements. (08 Marks)  
 c. Define: i) Etching ii) Metallization. (04 Marks)

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