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18EC33

Third Semester B.E. Degree Examination, Feb./Mar. 2022

**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 classification of semiconductor insulator and metals using energy band diagram. (08 Marks)
- b. Explain different types of bonding forces in solids. (04 Marks)
- c. What are intrinsic and extrinsic materials? Explain briefly by taking suitable example. (08 Marks)

OR

- 2 a. Define Hall effect in semiconductor. Obtain an expression for mobility in terms of Hall coefficient and resistivity. (08 Marks)
- b. Consider a semiconductor bar with width  $w = 0.1$  mm, thickness  $t = 10$   $\mu$ m, length  $L = 5$  mm. For  $B = 10$  KG ( $1$  KG =  $10^{-5}$  wb/cm<sup>2</sup>) and current of 1 mA. We have  $V_{AB} = -2$  mV and  $V_{CD} = 100$  mV. Find the type, concentration and mobility of the majority carrier. [Refer Fig.Q2(b)]

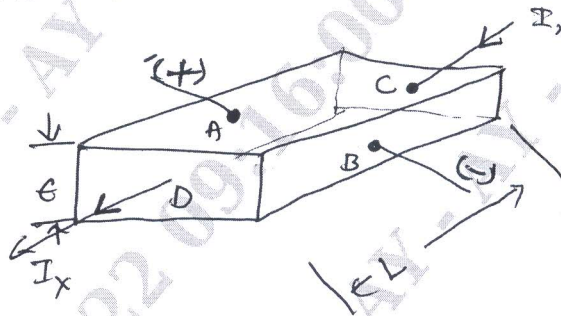


Fig.Q2(b)

- c. Derive an expression for conductivity and mobility from random thermal motion or electron in solid. (08 Marks)

**Module-2**

- 3 a. Explain the reverse bias p-n junction indicating the minority carrier distribution and variation of quasi fermi levels. (10 Marks)
- b. With a neat diagram, explain in detail Avalanche Breakdown and derive an approximate analysis of avalanche multiplication. (10 Marks)

OR

- 4 a. Derive an expression for current and voltage for an illuminated junction of protodiode and discuss the operation in various quadrants in I-V characteristic. (08 Marks)
- b. Explain the structure and operation of solar cell. Indicate the significance of Fill Factor. (08 Marks)
- c. A solar cell has a short circuit current of 100 mA and open circuit voltage of 0.8 V under full solar illumination fill factor is 0.7. What is maximum power delivered to load by this cell? (04 Marks)

**Module-3**

- 5 a. Explain the summary of hole flow and electron flow in p-n-p transistor with proper biasing and list three dominant mechanism which accounts for  $I_B$ . (10 Marks)
- b. Explain the process flow for double polysilicon self aligned BJT Fabrication. (10 Marks)

OR

- 6 a. Derive Eber's moll modes for Assymmetric Transistor (coupled diode model). (10 Marks)
- b. Write short notes on: (i) Base narrowing (ii) Avalanche Breakdown in transistor (10 Marks)

**Module-4**

- 7 a. Explain the structure and operation of pn JFET by varying  $V_{GS}$  and  $V_{DS}$  independently. (06 Marks)
- b. Write the small signal equivalent circuit of JFET and obtain the expression for transconductance ( $g_m$ ) and plot the graph with respect to  $V_{gs}$ . (06 Marks)
- c. Explain the operation of MOS capacitor using energy band diagram for p-type substrate when:
- Negative gate bias
  - Moderate positive gate bias
  - Large positive gate bias
- (08 Marks)

OR

- 8 a. Explain the ideal capacitance voltage characteristics of an MOS capacitor with p-type substrate. (08 Marks)
- b. Explain the operation of n-channel enhancement MOSFET and obtain the current voltage relationship. (08 Marks)
- c. Write the different types of MOS structures and symbols for each. (04 Marks)

**Module-5**

- 9 Explain briefly the various steps involved in the fabrication of p-n junction:
- Rapid thermal processing (05 Marks)
  - Ion implementation (05 Marks)
  - Chemical Vapor Deposition (CVD) (05 Marks)
  - Photolithography (05 Marks)

OR

- 10 a. Write a note on Integrated Circuit (IC) and its advantages and types of ICs. (10 Marks)
- b. Explain the fabrication of CMOS twin well process. (10 Marks)

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