Sub Code:NEC302

Paper Id: 130315

Roll No: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

B TECH
(SEM-III) THEORY EXAMINATION 2019-20
FUNDAMENTAL OF ELECTRONICS DEVICES

Time: 3 Hours   *Total Marks: 100*

Note: Attempt all sections. If require any missing data; then choose suitably

SECTION A

1. **Attempt all parts of this question**   **(2X10=20)**

    a) Define the semiconductors on the basis of energy band gap with neat sketch?
    b) In a simple cubic lattice find the ratio of intercepts on the three axes by (1, 3, 2) Plane?
    c) What type of semiconductor material is suitable for luminescence effect?
    d) A JFET has drain current of 5 mA. If I_{DSS} =10 mA and $V_{GS\,off}$= -6V find the value of V_{GS} and V_P?
    e) Why is it not possible to construct a germanium P-N-P-N switching diode?
    f) Define pinch-off voltage? What role does it play in Electronic devices
    g) Define Quasi Fermi level?
    h) What is Bragg's equation?
    i) What properties of a semiconductor are determined from a Hall Effect?
    j) Why MOSFET is known as IGFET?

SECTION B

2. **Attempt any three question from this section**   **(3X10=30)**

    a) In an N-type silicon sample, the Fermi Level is 0.3 eV below the conduction band edge. Find the electron and hole concentration in the sample at room temperature. For Si, E_g=1.1 eV, n_i = 1.5x10^{10} cm^{-3}
    b) Describe the solar cell? Why must a solar cell be operated in the fourth quadrant of the junction V-I characteristic?
    c) What do you mean by minority carrier injection and minority carrier extraction? Derive an expression for total current through the diode for either forward or reverse bias.
    d) What is steady state carrier generation? Prove that $\delta n = g_{op}\, \tau_n$ where g_{op} is optical generation rate and τ_n is the life time of carrier?
    e) What is MESFET? Why MESFET is usually made from GaAs or other compound semiconductor materials rather than from silicon? Enumerate the special features of MESFETs.

SECTION C

3. **Attempt any one question from this Section**   **(10X1=10)**

    a) (i) Discuss diffusion and drift of carriers?
       (ii)Derive the Einstein's relation?
    b) Prove that the concentration of free electrons in an intrinsic semiconductor is given by
    $$n = N_c\, e^{-(E_C - E_F)/kT}$$

4. **Attempt any one part of the following:**   **(10X1=10)**

    a) What is meant by carrier lifetime? Derive the continuity equation?
    b) (i) What is the Hall Effect and its application?
       (ii) An N channel JFET has pinch-off voltage of - 4.5 and I_{DSS} = 9 Ma. At what voltage of V_{GS} will I_{DS} be equal to 3 mA? What is its g_m at this I_{DS}?

5. **Attempt any one part of the following:**   **(10X1=10)**

   a) What do you mean by forward and reverse biased junction? Give a qualitative description of current flow at the junction? In a PN Junction, the reverse biased current is very small but it is increases abruptly beyond a certain reverse bias, Explain?
   b) (i) Draw the circuit diagram of a CE amplifier in BJT? Explain the mechanism of amplification?
   (ii) Distinguish between Zener breakdown and Avalanche breakdown?

6. **Attempt any one part of the following:**   **(10X1=10)**

   a) What are the different modes of operation in MOSFET? Draw the static drain characteristic and transfer characteristic curves for N-channel enhancement type MOSFET?
   b) What is photo-detector? Explain the operation of a p-i-n photo-detector. What are the suitable materials for it? How can it made more sensitive to low level intensity of light?

7. **Attempt any one part of the following:**   **(10X1=10)**

   a) What is transferred electron effect? Describe a device based on this effect with suitable diagram in detail. Also draw its characteristics.
   b) (i) Compare Zener diode and tunnel diode?
      (ii) Explain the Degenerate Semiconductor?