

Printed pages: 2

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**B.Tech.**  
**(SEM III) THEORY EXAMINATION 2017-18**  
**Fundamental of Electronic Devices**

Time: 3 Hours

Total Marks: 100

- Note:** 1. Attempt all Sections. If require any missing data; then choose suitably.  
2. Any special paper specific instruction.

**SECTION A**

- 1. Attempt all questions in brief. 2 x 10 = 20**
- Define the semiconductors on the basis of energy band gap with neat sketch?
  - In a simple cubic lattice find the ratio of intercepts on the three axes by (1, 3, 2) Plane?
  - The Minority carrier life time in p type material is  $10^{-7}$ s. The mobility of electron in silicon is  $0.15 \text{ m}^2\text{V}^{-2}\text{s}^{-1}$  at 300K. What is the diffusion length?
  - What type of semiconductor material is suitable for luminescence effect?
  - Why is collector current slightly less than emitter current?
  - A JFET has drain current of 5 mA. If  $I_{DSS} = 10 \text{ mA}$  and  $V_{GS \text{ off}} = -6\text{V}$  find the value of  $V_{GS}$  and  $V_P$ ?
  - Why is it not possible to construct a germanium P-N-P-N switching diode?
  - Why SCR can't be used as a bidirectional switch?
  - Define punch-off voltage?
  - Define Quasi Fermi level?

**SECTION B**

- 2. Attempt any three of the following: 10 x 3 = 30**
- 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,  $E_g = 1.1 \text{ eV}$   $n_i = 1.5 \times 10^{10} \text{ cm}^{-3}$
  - Describe the solar cell? Why must a solar cell be operated in the fourth quadrant of the junction V-I characteristic?
  - What is steady state carrier generation? Prove that  $\delta n = g_{op} \tau_n$  where  $g_{op}$  is optical generation rate and  $\tau_n$  is the life time of carrier?
  - What is meant by unit cell and lattice constant? Show that for a cubic lattice, the lattice constant  $a$  is given by  $a = \left( \frac{nM}{\rho N} \right)^{1/3}$  symbols has usual meaning.
  - Sketch and explain the construction and operation of a MISFET? Discuss its characteristic?

**SECTION C**

- 3. Attempt any one part of the following: 10 x 1 = 10**
- (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: 10 x 1 = 10**

a) What is meant by carrier lifetime? Derive the continuity equation?

b) (i) What is the Hall Effect and its application?

(ii) Derive the relation  $\theta_H = \tan^{-1} \theta(\mu B)$  ?

**5. Attempt any one part of the following: 10 x 1 = 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 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: 10 x 1 = 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) Explain the difference- (i) MOSFET and IGBT (ii) TRIAC and SCR

**7. Attempt any one part of the following: 10 x 1 = 10**

a) Explain the V-I characteristic of a photodiode? Why is GaAs an important semiconductor for the fabrication of the Gunn diode?

b) (i) Compare Zener diode and tunnel diode?

(ii) Explain the Degenerate Semiconductor?