Printed Pages:2 **Sub Code:KEC-301**

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B. TECH
(SEM III) THEORY EXAMINATION 2022-23
ELECTRONIC DEVICES

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

(a) Classify the materials on the basis of energy band gap theory.
(b) State the de Broglie principle of duality
(c) Define sheet resistance.
(d) Differentiate between drift and diffusion current.
(e) Draw the I-V characteristics of pn junction diode.
(f) Define the depletion region in a pn junction.
(g) Draw the input and output characteristics of BJT in CE configuration
(h) Determine the current gain β in CE configuration of BJT, if α=0.98.
(i) Draw the small signal model of NMOS transistor.
(j) Explain the photovoltaic effect.

SECTION B

2. Attempt any *three* of the following: **10x3=30**

(a) What do you mean by effective mass of electron? Derive the relation between effective mass and curvature of energy band.
(b) A Si sample is doped with 10^{17}arsenic (A_S) atoms / cm^3. Calculate the equilibrium concentration of electrons and holes at 300K. What is the position of fermi level (E_F) relative to intrinsic energy level (Ei)? Also draw the energy band diagram showing the position of fermi level and intrinsic energy level. Given that intrinsic carrier concentration (n_i)for Si is 1.5×10^{10} / cm^3
(c) Using the concept of drift and diffusion of carriers, derive the continuity equation.
(d) Explain Zener and Avalanche breakdown in detail.
(e) Write short note on following-
  (i) LED
  (ii) Solar cell

SECTION C

3. Attempt any *one* part of the following: **10x1=10**

(a) Derive the time dependent and time independent Schrodinger wave equation.
(b) Differentiate between direct and indirect band gap semiconductors. Also discuss the variation of energy band with alloy composition.

4. Attempt any *one* part of the following: 10x1=10

(a) Define Fermi-Dirac distribution function. Discuss the temperature dependence of Fermi-Dirac distribution function for semiconductor material

(b) Derive the Einstein's relation for electron.

5. Attempt any *one* part of the following: 10x1=10

(a) Derive the expression of depletion width in a p-n junction.

(b) Consider a Si abrupt p-n junction at 300K with $N_a = 10^{18}$ / cm^3 and $N_d = 10^{15}$ / cm^3. Determine the value of contact potential and width of depletion region. Given that intrinsic carrier concentration (n_i)for Si is 1.5×10^{10} / cm^3 and dielectric constant (K) for Si is 11.8.

6. Attempt any *one* part of the following: 10x1=10

(a) Discuss Schottky diode in detail and write its application.

(b) Draw and illustrate the Ebers-Moll model of BJT.

7. Attempt any *one* part of the following: 10x1=10

(a) Explain the accumulation mode, depletion mode and inversion mode with energy band diagram for a MOS capacitor.

(b) Explain the construction and working of N channel Enhancement type MOSFET and draw its drain characteristics and transfer characteristics.