Mr. Bagayp

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

MAKEUP EXAMINATION- 2016

B.Tech IV Semester

COURSE CODE: 10B11EC411 **MAX. MARKS: 25**

COURSE NAME: Semiconductor Devices

COURSE CREDITS: 04 **MAX. TIME: 1Hr 30 Min**

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

Q1. (a). What is ment by low level injection? **[5x1]**

(b). What is the need of Doping?

(c). Show the temperature dependency of mobility through graph.

(d). What is the effect of reverse bias on the width of the depletion region of a P-N junction?

(e). Define mean life-time of a carrier.

Q2. (a) Show that the physical characteristics of the transition capacitance are similar to the parallel-plate capacitor and prove that $C_T = \frac{A\varepsilon}{W}$, where A is the cross-sectional area of the diode and W is the width of the depletion layer. **[3]**

(b) Which diode capacitance is significant in the forward direction and which one is significant in the reverse direction? Plot the variation of the capacitance with forward bias and reverse bias. **[2]**

Q3. (a) Derive the diffusion equation for holes from the equation of continuity and find out its solution. **[3]**

(b) The depletion region extends deeper into the lightly doped (N) region of the diode. Explain why? **[2]**

Q4. A PN^+ Si junction diode is doped with $N_D = 10^{16}/cm^3$ and $N_A = 10^{15}/cm^3$. Determine the location of Fermi levels With respect to the bottom of the conduction band on each side of the junction. Draw the energy band diagram. For Si, $n_i = 10^{10}/cm^3$. **[3+2]**

(b) Explain the movement of energy bands (with diagram)

(i) When diode is forward biased? **(ii)** When diode is reversed biased?

(c) How does an increase of diode reverse-bias increase the diode reverse current?

Q5. Maximum value of electric field is given by: **[5]**

$$E_0 = \frac{-qN_aX_{po}}{\varepsilon} = \frac{-qN_dX_{no}}{\varepsilon}$$

Prove that: $W = \sqrt{\frac{2\varepsilon Vo}{q}\frac{Na+Nd}{NaNd}}$