Printed Pages : 2 **Roll No.** | | | | | | | | | | | **EEC013**

B.TECH.

THEORY EXAMINATION (SEM–VI) 2016-17

ADVANCED SEMICONDUCTOR DEVCES

Time : 3 Hours ***Max. Marks : 100***

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Attempt the following: **10 x 2 = 20**

(a) What are the simple cubic, bcc and fcc structures?

(b) Why does semiconductor behave as an insulator at 0K?

(c) What is Fermi level? Write its significance.

(d) What is impurity and lattice scattering?

(e) What is the difference between drift and diffusion current?

(f) Define mobility of a carrier.

(g) Why is Hall effect useful?

(h) What is the significance of negative resistance in Tunnel diode?

(i) What are delays in IMPATT diode?

(j) What is solar cell?

SECTION – B

2. Attempt any five of the following questions: **5 x 10 = 50**

(a) Derive the condition for minimum conductivity of a semiconductor sample and compare result at 300K with intrinsic conductivity. A Sample of Si is doped with 10^{17} phosphorous atoms/cm^3. What hall voltage would you expect in a sample 100μ m thick, if I_x=1mA, B_z=1kG=10^{-5} wb/cm^2? What is high field effect in semiconductors?

(b) Derive the expression for Conductivity and Mobility and also the expression for Diffusion of carriers in semiconductors.

(c) Derive the expression for carrier generation and recombination and High level injection effect in Real diodes.

(d) Explain Trapping. Derive the Basic carrier transport equation for semiconductor device operation.

(e) In a Si sample 10^{13} EHP/cm^3 are created optically every microsecond with n_0=10^{14}/cm^3 and t_n=2μsec and t_p=1μsec. find steady state excess electron and hole concentrations and also estimate separation between quasi Fermi levels by showing in band diagrams.

(f) Derive the expression for Electric field in Linear Graded Junction. In a very long p-type Si bar with cross sectional area=0.5cm^2 and N_a=10^{17}/cm^3, we inject holes such that the steady state excess hole concentration is 5X10^{16}/cm^3 at x=0. Find hole current and excess stored hole charge at 1000Å. Assume μ_p= 500cm^2/v-s and t_p=10^{-10}sec.

(g) An abrupt Si p-n junction (A=$10^{-4}$$cm^2$) has the following properties at 300K. p-side→N_a=10^{17}/cm^3, t_n=0.1us,μ_p=200cm^2/v-s,μ_n=700;n-side→N_d=10^{15}/cm^3, t_p=10us, μ_n=1300, μ_p=450. The junction is forward biased by 0.5V. What is the forward current? Reverse bias voltage= -0.5V. Find Reverse Current.

(h) Explain I-V characteristics of Real diodes and also explain Breakdown mechanism in p-n junction diode.

SECTION – C

Attempt any two parts of the following questions: 2 x 15 = 30

3. What is Varactor diode? Explain its working with diagram. What are its advantages and disadvantages and applications? Explain fill factor in solar cell.

4. Explain IMPATT Diode and its working. What is Transferred electron Mechanism?

5. What is Light emitting diode? Explain its working principle. What are the materials used in LED? Explain its uses.