Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
JUNE 2019
SUBJECT: SEMICONDUCTOR DEVICE PHYSICS (ECE - 4015)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. A Si bar of 0.1cm long and 100μm^2 in cross sectional area is doped with 10^{17} cm^{-3} phosphours. Find the current at 300K with 10V applied. μ_n=700 cm^2/V-sec.

1B. How long does it take an average electron to drift 1μm in pure Si at an electric field of 100V/cm. Repeat for 10^5 V/cm. μ_n=1350 cm^2/V-sec'

1C. Draw the band diagram for semiconductor in the applied electric field. Explain.

(3+4+3)

2A. How can you measure the minority charge carrier life time in PN junction.

2B. Describe the stored charge dynamics in a PN junction when the forward bias-supply is switched off suddenly

2C. In P $^+$ N junction, the n doping N_D is doubled. How do the following changes if everything remains unchanged. a) Junction Capacitance b) Built in potential

(3+4+3)

3A. An n-type Ge sample is used in the Hynes-Shockley experiment. The length of the sample is 1cm and probes are seperated by 0.95cm and powevered by 2V. A pulse arrives at the far-end of the samle 0.25ms after injection is initated. The width of the pulse is 117μs. Calculate the hole mobility and diffusion co-efficient and verify with Einstein relation

3B. A Si PN junction with cross-sectional area 0.001cm^2 is formed with $N_a=10^{15}$cm^{-3}, $N_d=10^{17}$cm^3, Calculate a) Contact potential b) Space charge width c) Current with forward biasing of 0.5V. The data given: μ_n=1500cm^2/VS, μ_p=450cm^2/VS, $\tilde{\imath}_p=\tilde{\imath}_n$=2.5ms.

(4+6)

4A. The work function of Pt is 5.0eV and electron effinity of Si (P-type) is 4.05eV and doping concentration is $N_A=10^{15}$cm^{-3}. Determine the barrier height Φ_{BP}, work function of semiconductor and built-in potential. Assume $N_v=10^{19}$cm^{-3}.

4B. Derive an expression for the IV characterisics of MS contact.

(5+5)

5A. Explain the behaviour of MOS capacitor in different regions of operation with the aid of capacitance measurement with respect to voltage.

5B. With the aid of band diagram, explain the behaviour of MOS structure in the accumalation mode.

(6+4)