VIT
Vellore Institute of Technology

Continuous Assessment Test – I

Programme Name & Branch: B.Tech – ECE

Course Code & Name: ECE1002 – Semiconductor Devices and Circuits

Class Number: VL2018195001226, 1229, 1232, 1234, 1236, 1240, 1248

Date of Exam: 22/01/2019 **Slot:C2+TC2 Exam Duration:02:00 P.M – 03:30 P.M**
Maximum Marks: 50 Marks

Important constants: k=1.38×10^{-23} J/K, h=6.625x10^{-34} J-s, m_0=9.11×10^{-31} kg, ϵ_0=8.85×10^{-14} F/cm, q = 1.6 × 10^{-19}C, For Si: E_g = 1.12 eV, n_i (300 K) = 10^{10}/cm^3, $\varepsilon_s = 11.7\varepsilon_o$

Section – A (10 x 5 = 50 Marks)*

S.No.	Question
1.	a. Due to shining of light pulse for 1 ms on a doped semiconductor, excess charge carriers of Δp= 10^{20}/cm^3 are produced. If the doping concentration is 10^{15} cm^{-3} andintrinsic carrier concentration is 10^{11} cm^{-3}, with recombination lifetime is 10 μs and mobility of μ_p = 470 $cm^2/V{\cdot}s$, calculate the following: 1. Generation and recombination rate 2. Diffusion coefficient 3. Diffusion length b. Electrons of undoped gallium arsenide have effective mass of 0.067 m_0 and mean free time 0.3 ps. Calculate the following: 1. Electron mobility 2. Resistivity
2.	Consider an intrinsic silicon bar of cross-section of 5 cm^2 and length 0.5 cm at room temperature 300 K. An average field of 20 V/cm is applied across the ends of silicon bar. Assumeμ_n = 1400 cm^2/Vs, μ_p = 450 cm^2/Vs Calculate (i). Electron and hole component of current density. (ii).Total current in the bar. (iii) Resistivity of the bar
3.	An N-type silicon bar is 3 mm long and has a rectangular cross section 50 μm ×100 μm. The donor concentration at 300 K is 5X10^{14} /cm^3, a steady drift current = 1 μA exists in the bar, determine the electron - hole concentrations, the conductivity (at 300 K, μ_n=1500 $cm^2/V{\cdot}s$), and the voltage across the bar.
4.	Consider a silicon crystal at a temperature of 400 K doped with 6x10^{16} arsenic atoms per cm^3. Find: 1. The type of semiconductor. 2. N_c, N_v and n_i at 400 K.