

B.Tech. Degree III Semester Examination November 2013**EC/EI 1305 SOLID STATE ELECTRONICS**
(2012 Scheme)

Time : 3 Hours

Maximum Marks : 100

PART A
(Answer *ALL* questions)

(8 × 5 = 40)

- I. (a) Discuss the postulates of quantum mechanics
 (b) Explain the Fermi-Dirac distribution function applied to semiconductors
 (c) Discuss the different types of breakdown that occurs in the diode.
 (d) Briefly explain the different types of P-N junction diodes based on fabrication process.
 (e) Explain the operation of a JFET as a VVR device?
 (f) Explain the principle of operation of a MOSFET device.
 (g) Write notes on base width modulation and punch through effect
 (h) Explain the function of transistor as a switch with suitable diagram.

PART B

(4 × 15 = 60)

- II. (a) Derive the expression for electron and hole concentration at equilibrium. (10)
 (b) A Ge sample is doped with 5×10^{13} arsenic atoms/cm³. Determine the carrier concentration and Fermi level position at 300^oK (n_i for Ge = 2.5×10^{13} cm³ at 300^oK) (5)
- OR**
- III. (a) Obtain the Schrodinger wave equation of a particle in potential well. (10)
 (b) An n-type Si bar, 0.1cm long and $100 \mu\text{m}^2$ in cross sectional area has a major carrier concentration of 5×10^{15} cm⁻³ and electron mobility is 1300 cm²/V at 300^oK. What is the resistance of the bar? (5)
- IV. Derive the ideal diode equation. (15)
- OR**
- V. (a) Derive an expression for depletion layer width of a P-N junction diode. (10)
 (b) Plot the V-I characteristics of a Ge & Si diode. Explain. (5)
- VI. What is a MOS capacitor? Explain the C-V characteristics of an ideal MOS system with suitable diagram. Obtain the expression for the threshold voltage also. (15)
- OR**
- VII. (a) Explain the principle of operation of JFET. (5)
 (b) Derive the expression for I_{DSS} . (5)
 (c) Discuss the V-I characteristics of a MOSFET. (5)
- VIII. (a) Explain the V-I characteristics of a transistor in CE configuration with suitable diagrams (9)
 (b) Explain the various current components of a PNP transistor with suitable diagrams. (6)
- OR**
- IX. (a) Draw Ebers - Moll Model of PNP transistor and write the Ebers-Moll equations. Explain the terms involved. (10)
 (b) Write notes on Emitter crowding and Emitter injection efficiency (5)
