

B.E / BTech ( Full Time) DEGREE END SEMESTER EXAMINATIONS, APR / MAY 2013

ELECTRONICS AND COMMUNICATION ENGINEERING

SECOND SEMESTER

EC 9151 – ELECTRON DEVICES

(REGULATION – 2008)

Time: 3 hours

Max.Marks: 100

Answer ALL Questions

Part A – (10 x 2 = 20 Marks)

1. In a P-N junction, under open circuited condition, the net hole current must be zero – Justify.
2. Calculate the built in voltage in a P – N junction, with  $N_A = 1.5 \times 10^{15} \text{ cm}^{-3}$ ,  $N_D = 1.2 \times 10^{15} \text{ cm}^{-3}$ ,  $n_i = 1.5 \times 10^{10} \text{ cm}^{-3}$  and  $T = 300\text{K}$ .
3. What is the significance of "Early" effect in BJT ?
4. List the three BJT parameters required for Ebers- Moll equivalent circuit of a BJT.
5. Calculate the width of a depletion region in a junction with the following parameters  $\epsilon_s = 13.1$ ,  $V_{bi} = 0.67$ ,  $N_D = 1 \times 10^{16}$ .
6. What factors does the maximum to minimum capacitance ratio in a MOSFET depend on ?
7. Determine the barrier height of the metal semiconductor (MS) junction with  $A = 4.4 \text{ A/(K}^2\text{cm}^2)$ ,  $T = 300\text{K}$  and  $J_s = 5 \times 10^{-8} \text{ A/cm}^2$ .
8. Give the principle of Light Dependent Resistor.
9. What are the significant differences between FET and UJT operation?
10. Define "Fill factor" in a Solar cell.

Part – B (5 x 16 = 80 Marks)

11. (i) Explain the concept of Space charge layer in semiconductor junctions. (4)  
(ii) Discuss the electric field and potential within space charge layer for an abrupt junction and hence derive the expression for the width of the depletion region. (12)
12. a.(i) With the schematic of the structure and carrier concentration profiles of a NPN Transistor, derive the detailed expressions for the current components. (12)

(ii) Explain the "emitter efficiency" and "transport factor" in transistor. (4)

(OR)

b.(i) Explain the H parameter model of NPN transistor with neat circuit. (8)

(ii) Compare the features of Ebers – Moll model and Gummel Poon model. (8)

13.a.(i) With a neat diagram, Explain the structure of JFET. (4)

(ii) Derive an expression for  $I_{Dsat}$  in the case of a JFET and discuss the output characteristics. (12)

(OR)

b.(i) Discuss the C-V characteristics of a MOS structure. (6)

(ii) Explain the above threshold I – V characteristics of a MOSFET, with relevant mathematical treatment. (10)

14.a.(i) Explain the energy band diagram for a metal – N type semiconductor junctions under different conditions. (6)

(ii) Discuss in detail, the current transport in metal – semiconductor junction and hence deduce an expression for thermionic emission current. (10)

(OR)

b.(i) With relevant band diagrams, explain the conditions for tunneling in P-N junctions. (8)

(ii) Explain the principle and construction of a semiconductor laser diode. (8)

15.a.(i) Explain the structure and operating conditions of an SCR, with two transistor equivalent circuit. (10)

(ii) Compare all the features of SCR and TRIAC. (6)

(OR)

b. Write detailed note on principle, construction and working of (i) CCD (ii) Multi emitter transistor.