

Roll No.

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, April - May 2014

ELECTRONICS AND COMMUNICATION ENGINEERING

SECOND SEMESTER

**EC 9151 - ELECTRON DEVICES
(REGULATIONS 2008)**

Time: 3hour

Max Marks: 100

Answer ALL Questions

Part A - (2 x 10 = 20 Marks)

1. Calculate the built in potential barrier in a silicon PN junction at 300K for $N_a = 5 \times 10^{17} \text{cm}^{-3}$ and $N_d = 10^{16} \text{cm}^{-3}$. Assume $n_i = 1.5 \times 10^{10} \text{cm}^{-3}$.
2. What do you understand by "turn off" transient in junction diodes?
3. Define common base current gain.
4. Why does second breakdown occurs at power BJT's?
5. Determine the internal pinch off voltage in a N channel JFET at 300K with $N_a = 10^{18} \text{cm}^{-3}$ and $N_d = 10^{16} \text{cm}^{-3}$. Assume 'a' = 0.75 μm , $\epsilon_r = 11.7$
6. Define "Flat band" voltage in MOS structures.
7. Draw the energy band diagram of a metal – n- semiconductor junction for $\Phi_m > \Phi_s$.
8. Give the principle of Light dependent resistor.
9. Define "Holding current" in a SCR.
10. Calculate the open circuit voltage of a solar cell with $J_L = 15 \text{mA/cm}^2$, $J_S = 3.6 \times 10^{-11} \text{A/cm}^2$. Assume $V_T = 26 \text{mV}$.

Part B - (16 x 5 = 80 Marks)

- 11.(i) Explain the theory of P-N junction formation with necessary diagrams. (6)
- (ii) From the Poisson's equation, derive the expression for potential through the P-N junction. (10)
- 12.a.(i) Discuss in detail, the bipolar transistor action with relevant diagrams and current relations. (8)

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(ii) Derive the expression for excess minority carrier concentration in the base region of a bipolar transistor in forward active mode. (8)

(Or)

b.(i) Explain the Hybrid Pi model of a NPN bipolar transistor and its components. (6)

(ii) Describe the time delay factors affecting the frequency response of a bipolar transistor (4)

(iii) Illustrate the features of Gummel-Poon model for transistor. (6)

13.a.(i) Discuss the channel region variations and $I - V$ characteristics of a JFET under zero gate voltage with variation in V_{DS} . (8)

(ii) Derive the expression for pinch off current in a JFET. (8)

(Or)

b.(i) Discuss the characteristics of MOS structure with relevant band diagrams. (8)

(ii) Derive an expression for threshold voltage in the case of a MOS structure. (8)

14.a.(i) Explain the principle and operation of a Schottky barrier diode. (8)

(ii) Deduce expressions for barrier height, built-in potential and electric field in the case of a metal semiconductor junction. (8)

(Or)

b.(i) Enumerate the properties of materials for LASER diode. (6)

(ii) Explain the band structure and operation of a PN junction LASER diode. (10)

15.a.(i) Discuss the structure, principle of operation and characteristics of a SCR with relevant diagrams. (10)

(ii) Outline the constructional features of VMOS. (6)

(Or)

b.(i) Explain the principle and operation of a Photo transistor. (8)

(ii) Write a detailed note on Solar cell and Multi emitter transistor. (8)