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**Question Paper Code : 91439**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Second Semester

Electronics and Communication Engineering

EC6201 – ELECTRONIC DEVICES

(Regulations 2013)

(Common to PTEC 6201 – Electronic Devices for B.E. (Part-time) First Semester – Electronics and Communication Engineering – Regulations – 2014)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Find the built in potential for a Germanium diode having  $N_A = N_D = 0.58 \times 10^{15}/\text{cm}^3$  and  $n_i = 2.5 \times 10^{13}/\text{cm}^3$ . Assume  $V_T = 26 \text{ mV}$ .
2. What do you understand by “recovery time” in a junction diode ?
3. Define “large signal current gain  $\alpha$ ” of a BJT.
4. What is the need for multi electrode transistor ?
5. A FET has a drain current of 4 mA. If  $I_{DSS} = 8 \text{ mA}$  and  $V_{GS(off)} = -6\text{V}$ , find the value of  $V_{GS}$ .
6. What is the important difference between FINFET and planar transistor ?
7. Zener diode can be used as regulator – Justify.
8. State the principle of LDR.
9. Determine the intrinsic stand off ratio of an UJT, whose  $R_{BB} = 10 \text{ k}\Omega$  and  $R_{B1} = 6 \text{ k}\Omega$ .
10. A solar cell has current densities  $J_L = 150 \text{ mA}/\text{cm}^2$  and  $J_s = 3.6 \times 10^{-11} \text{ A}/\text{cm}^2$ . What is its open circuit voltage at room temperature ?

PART – B

(5×16=80 Marks)

11. a) From the transport equation for minority carriers, derive an expression for ideal current-voltage relationship in a PN junction. (16)
- (OR)
- b) i) Draw a simple circuit for switching a diode from forward to reverse bias and explain the minority carrier concentration during the switching. (10)
- ii) Brief about the current characteristic versus time during diode switching. (6)



12. a) i) Discuss the bipolar transistor action with biasing arrangement in a NPN transistor along with energy band diagram under different bias. (10)
- ii) Give the expression for collector current, total emitter current and base current for a NPN bipolar transistor. (6)
- (OR)
- b) i) For a NPN bipolar transistor in common emitter mode deduce the hybrid equivalent circuit and explain the various components. (10)
- ii) Discuss the various factors that lead to time delay in a bipolar transistor. (6)
13. a) i) With a neat schematic of a JFET structure, derive an expression for the ideal current-voltage relationship in depletion mode. (10)
- ii) Consider a silicon p channel JFET at  $T = 300$  K. Assume that the gate doping concentration is  $N_d = 10^{18} \text{ cm}^{-3}$ . Determine the built in potential, internal pinch off voltage and channel thickness, if  $N_a = 2 \times 10^{16} \text{ cm}^{-3}$  and pinch off voltage,  $V_p = 2.25$  V. (6)
- (OR)
- b) i) Explain the concept of flat band voltage in a MOSFET. Also deduce an expression for the same. (8)
- ii) Consider an  $n^+$  polysilicon gate and a p-type silicon substrate doped to  $N_a = 3 \times 10^{16} \text{ cm}^{-3}$ . Assume  $Q_{ss}^1 = 10^{11} \text{ cm}^{-2}$ . Determine the oxide thickness such that  $V_{TN} = +0.65$  V. (8)
14. a) i) Outline the basic MESFET operation with energy band diagrams and space charge region under different  $V_{GS}$  values. (8)
- ii) Consider an N channel GaAs MESFET at  $T = 300$  K with a gold Schottky barrier contact. Assume the barrier height is  $\phi_{Bn} = 0.89$  V and  $V_T = 0.25$  V. The N channel doping is  $N_d = 2 \times 10^{15} \text{ cm}^{-3}$  and conduction band density of states ( $N_c$ ) =  $4.7 \times 10^{17} \text{ cm}^{-3}$ . Determine the channel thickness. (8)
- (OR)
- b) Enumerate the conditions required for lasing action and explain how they can be achieved in laser diodes, with relevant diagram. (16)
15. a) i) Explain the construction and operation of power bipolar transistors. (8)
- ii) Consider a power BJT connected in a common emitter circuit with  $R_L = 10\Omega$  and  $V_{CC} = 35$  V. Determine the required current, voltage and power rating of the BJT. (8)
- (OR)
- b) i) Brief about the structure and characteristics of Solar cell. (8)
- ii) Explain the principle and applications of CCD. (8)