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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 $N_A = N_D = 0.58 \times 10^{15}/cm^3$ and $n_i = 2.5 \times 10^{13}/cm^3$. Assume $V_T = 26$ 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 $I_{DSS} = 8$ mA and $V_{GS(off)} = -6$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 $R_{BB} = 10$ k$\Omega$ and $R_{B1} = 6$ k$\Omega$.
10. A solar cell has current densities $J_L = 150$ mA/cm$^2$ and $J_s = 3.6 \times 10^{-11}$ A/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 $N_d = 10^{18}$ cm$^{-3}$. Determine the built in potential, internal pinch off voltage and channel thickness, if $N_a = 2 \times 10^{16}$ 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 $N_a = 3 \times 10^{16}$ cm$^{-3}$. Assume $Q'_{ss} = 10^{11}$ 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 $N_d = 2 \times 10^{15}$ cm$^{-3}$ and conduction band density of states $(N_c) = 4.7 \times 10^{17}$ 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)**