

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)**

CLASS: BE
BRANCH: ECE

SEMESTER: III
SESSION : MO/2018

SUBJECT : EC3205 SEMICONDUCTOR DEVICES

TIME: 1.5 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The total marks of the questions are 30.
2. Candidates may attempt for all 30 marks.
3. In those cases where the marks obtained exceed 25 marks, the excess will be ignored.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. The missing data, if any, may be assumed suitably.

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- Q1 (a) Write down the expression for probability function? Explain each term in it. [2]
(b) Plot (a) band diagram, (b) density of states, (c) Fermi-Dirac distribution, and (d) the carrier concentrations for n-type semiconductors at thermal equilibrium. [3]
- Q2 (a) The intrinsic level E_i lies exactly at the middle of the band gap ($E_C - E_V = E_G/2$). The statement is true or false. If false why? [2]
(b) Assume that intrinsic carrier concentration $n_i = 1.5 \times 10^{10}$. A Silicon sample is doped with 10^{17} Antimony atoms/cm³. What is the equilibrium hole concentration p_0 at 300 K? How far away is the Fermi Energy level, E_F with respect to intrinsic energy level? [3]
- Q3 (a) Define diffusion length and minority carrier life time. [2]
(b) Explain how a pulse of excess electrons injected at $x = 0$ at time $t = 0$ will spread out in time. Substantiate your answer with suitable diagram. [3]
- Q4 (a) Differentiate between Hall effect and Haynes-Shockley experiment in relation to measurement of carrier mobility? [2]
(b) Draw a plot to explain how injected excess hole concentration dies out exponentially with x (distance) due to recombination in steady state condition. [3]
- Q5 (a) Why is the transition region formed? Why does it stop widening? [2]
(b) What is barrier potential? Barrier potential cannot be measured. The statement is true or false. What is the value of barrier potential for Si PN junction? [3]
- Q6 (a) Explain the physical meaning of $C_d(0)$? [2]
(b) In a p-n junction, if n-type region is on the $-x$ side and p-type region is on the $+x$ side, draw the plot of electric field with $-w_n$ and $+w_p$ being the penetration of depletion region in n-side and p-side respectively. [3]