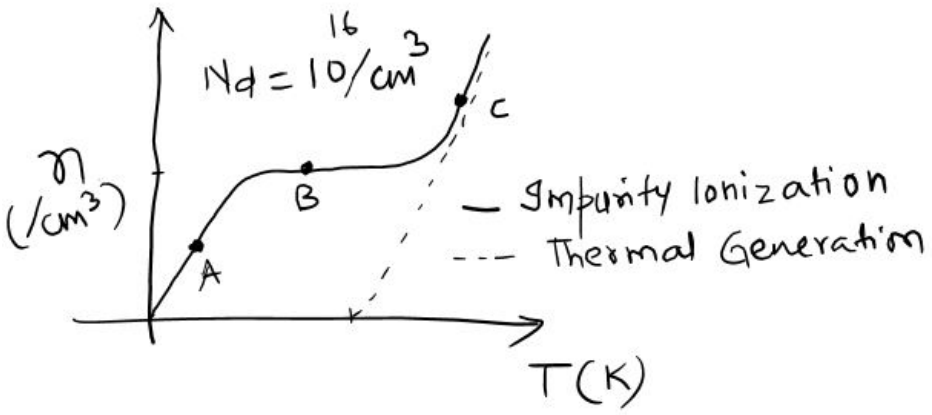
BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

CLASS: B.TECH. **SEMESTER: III**
BRANCH: ECE **SESSION: MO/2022**

SUBJECT: EC201 ELECTRONIC DEVICES

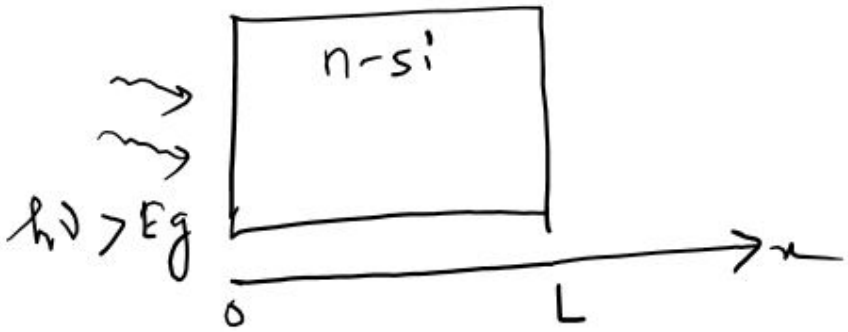
TIME: 2 HOURS **FULL MARKS: 25**

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q1 (a)	A p-type Si semiconductor, with doping $10^{14}/cm^3$ is heated to 450 K and 10^{17} bonds are broken. a1) What are the carrier concentrations before heating? [1] a2) What are the carrier concentrations after heating? [1]	[2]	1	2
Q1 (b)	There are 3 samples S1, S2 and S3. S1 is doped with 10^{16} Boron atoms/cm^3, S2 is doped with 10^{14} phosphorous atoms/cm^3 and S3 is undoped. Draw the energy band diagram showing the exact position of fermi level from conduction and valence band for all 3 samples at 300 K. (Given: Nc = Nv = $10^{19}/cm^3$) [1+1+1]	[3]	1	3
Q2 (a)	a1) Show the variation of mobility of charge carriers vs temperature (both in log scale). [2] a2) Does mobility increase or decreases at higher temperatures? [0.5] a3) What is the phenomena responsible for this increase or decrease? [0.5]	[2]	1	2
Q2 (b)	In given figure,  What is the possible carrier concentration at A, B and C? [1+1+1]	[3]	1	4
Q3 (a)	Show the variation of fermi-level in n-type semiconductor with temperature and doping. [1+1]	[2]	1	3
Q3 (b)	b1) Derive Einstein relationship for electrons. [2] Bb) What are the two modes of carrier transport linked with the Einstein relationship? [1]	[3]	2	2
Q4 (a)	Write any two types of recombination process. [1+1]	[2]	2	1
Q4 (b)	Write the five basic equations (either name or mathematical expression) for electrons and holes both that govern the charge carrier action for device analysis.	[3]	2	

PTO

Q5 (a)	Calculate the current density in a uniformly doped n-type Si sample if donor concentration is $10^{15}/cm^3$ and an electric field of 5 KV/cm is applied across it at 300 K.	[2]	2	2
Q5 (b)		[3]	2	4



For the above figure, if $10^{12}/cm^3$ electron-hole pairs are created after shining the light. If donor concentration is $10^{16}/cm^3$.

b1) Plot the variation of majority carrier concentration with 'x' from 0 to L. [1]
b2) Plot the variation of minority carrier concentration with 'x' from 0 to L. [1]
b3) Which type of carrier will diffuse in this case. Show the diffusion length, Lp with corresponding value of the carrier concentration at the Lp. [1]

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