Hall Ticket Number:

Code No. : 11023B

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (CBCS) I-Semester Main Examinations, Dec.-2018 / Jan.2019

Semiconductor Physics

(CSE & IT)

Time: **3** hours Max. Marks: **60**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Q. No	Stem of the Question	M	L	CO	PO
	Part-A (10 × 2 = 20 Marks)				
1.	Distinguish between crystalline and amorphous materials.	2	1	1	1,2,12
2.	Discuss the crystal structure of NaCl with a neat diagram.	2	2	1	1,2,12
3.	List out the successes and failures of Drude free electron theory.	2	2	1	1,2,12
4.	Calculate effective density of states for conduction band in GaAs at 300K assuming m_e^* as $1.08m_e$.	2	3	1	1,2,12
5.	Write a note with examples on acceptor and donor impurities.	2	1	2	1,2,12
6.	Evaluate intrinsic carrier concentration of a semiconductor at 300K from the following data: resistivity 10^6 ohm-m, mobilities of electron and holes are 0.80 m^2/V-s and 0.05 m^2/V-s respectively.	2	3	2	1,2,12
7.	How much time an average electron takes to drift 10 micrometers in pure silicon at an electric field 100V/cm. Assume electron mobility in silicon is 1350cm^2/V-s.	2	3	3	1,2,12
8.	Estimate diffusion coefficient and diffusion length of a hole at 300K taking carrier life time as 10^{-10} sec and mobility 500cm^2/V-s.	2	3	3	1,2,12
9.	Differentiate between photovoltaic effect and photoelectric effect.	2	1	4	1,2,12
10.	Write a note on semiconducting materials used in optoelectronic devices.	2	2	4	1,2,12
	Part-B (5 × 8 = 40 Marks)				
11. a)	State Bragg's law. Describe the powder X-ray diffraction method to determine lattice constant of a crystal.	5	3	1	1,2,12
b)	Calculate ratio of Frenkel defects in one-gram crystal at 30°C and 300°C if energy required to create one Frenkel defect is 1.25eV.	3	3	1	1,2,12
12. a)	Obtain expression for density of states (DOS) for a semiconductor of volume V.	5	3	1	1,2,12
b)	Mention and discuss the conclusions of Kronig-Penney Model?	3	2	1	1,2,12
13. a)	Arrive at the expression for intrinsic carrier concentration in a semiconductor.	5	3	2	1,2,12
b)	Discuss variation of Fermi level with temperature and carrier concentration.	3	3	2	1,2,12
14. a)	Attain equation of continuity for holes and electrons in a semiconductor.	5	3	3	1,2,12
b)	A PN junction at 300K under no bias condition has donor and acceptor doping concentrations respectively 2.5×10^{15} and 5×10^{14} per cubic centimeter. Calculate width of depletion layer in n-region, p-region and total width of the depletion region. The built in voltage is 0.54V and relative dielectric constant is 12.9.	3	4	3	1,2,12

Contd... 2

Code No. : 11023B

15. a)	What are trap centers in a semiconductor? Discuss SRH mechanisms for recombination of charge carriers.	5	4	4	1,2,12
b)	Describe stimulated emission and arrive at expression for gain coefficient.	3	2	4	1,2,12
16. a)	What are Schottky defects? Derive expression for Schottky defects in an ionic crystal.	5	3	1	1,2,12
b)	Give is physical significance of wave function? Evaluate probability of finding a particle in a box of infinite height and $20A^0$ width at the center within an interval of $2.5A^0$.	3	2	1	1,2,12
17.	Answer any ***two*** of the following:				
a)	State Hall's effect and Derive expression for Hall voltage.	4	3	2	1,2,12
b)	Discuss formation of a PN junction in equilibrium with neat band diagram.	4	3	3	1,2,12
c)	Write a note on radiative and non-radiative transitions.	4	3	4	1,2,12

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome
* POs 1, 12 for CSE and 1, 2 for IT

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	60%
2	Knowledge on application and analysis (Level-3 & 4)	40%
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	