Roll No. .....

3003

B. Tech. 1st Semester (CSE) Examination – December, 2018

SEMICONDUCTOR PHYSICS

Paper : BSC-PHY-103-G

Time : Three Hours] *[Maximum Marks : 75*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt ***five*** questions in all, selecting ***one*** question from each Unit. Question No. 1 is ***compulsory***. All questions carry equal marks.

1. (a) Semiconductors have negative temperature coefficient of resistance. Explain its meaning. 2.5

(b) What are indirect and direct band gap semiconductors ? 2.5

(c) Discuss E-K diagrams and brief the origin of energy band in solids. 2.5

UNIT – IV

8. Derive suitable expression and explain the vander paw and four point probe measurement for the carrier density of a semiconductor. 15

9. What are 3D, 2D, 1D and 0D systems/structures in solids ? Derive expression for the density of states and give plots between the density of state and energy for each system. 15

(d) Calculate the static and dynamic resistance of a Ge diode at room temperature (25°C). Given reverse saturation current (I_s) = 1A, and bias voltage (V)=.5V. 2.5

(e) Write a short note on (LDR) optoelectronic device. 2.5

(f) Give a brief explanation for hetrojunction devices. 2.5

UNIT – I

2. (a) Show that for a completely filled band in solids the number of effective electrons vanish. 5

(b) Discuss the motion of a free electron in one dimensional potential box and derive expressions for eigen wave function and eigen state. 10

3. What is the effect of Periodic potential on the energy of an electron in a Metal ? Explain it on the basis of Kronig-Penny Model. 15

UNIT – II

4. (a) What do you understand by carrier transport phenomenon in semiconductors ? Discuss carrier transport through Diffusion. 7

(b) What are Ohmic and Schottky contacts with reference to metal-semiconductor junction. How they are different then a p-n junction ? 8

5. (a) Show that Fermi level for an Intrinsic semiconductor lies exactly in the middle of valance band and conduction band.' 7

(b) What is an Intrinsic semiconductor ? Discuss the variation of Fermi level with temperature for an N-type semiconductor. 8

UNIT – III

6. (a) What is Density of states ? Derive an expression for joint density of states for a semiconductor substance. 10

(b) On account of optical transition, define induced absorption, spontaneous emission and stimulated emission. 5

7. (a) What is transition rate ? Derive an expression for any one of the rate of transition (r_{sp}) for semiconductor substance. Also show how this transition rate (P_{sp}) varies with energy. 10

(b) What is photovoltaic effect ? Give the construction and working of a Solar cell. 5