Roll No…….. **Total No. of Printed Pages: 01**

Total No. of Questions: [09]

B.Tech (Textile Engg.) (Semester – 1st)

PHYSICS (SEMICONDUCTOR PHYSICS)

Subject Code: BPHYS1-101

Paper ID: [18112601]

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1. Attempt the following:

a) If proton and alpha particle have same kinetic energy, then what is the ratio of their de-Broglie's wavelength?

b) What do you mean by degenerate state?

c) Evaluate the Fermi function for an energy kT above the Fermi energy.

d) Show that the one-dimensional time independent Schroedinger equation is an example of eigenvalue equation

e) Does Fermi energy of a metal depend upon temperature and total number of electrons in the sample? Explain.

f) What are diffusion and drift currents for a PN junction diode? How a contact potential is developed across it?

g) Define the term Numerical Aperture of an optical fibre. What is its value for a long distance communication?

h) Explain the meaning of well-behaved wave function.

i) Show that $\psi(x)= e^{icx}$ is acceptable eigen function, where c is finite constant. Also normalize it over the region $-a \le x \le a$.

j) Show that a band can accommodate 2N electrons, where N is number of atoms in a crustal.

Section – B **(5 marks each)**

Q2. The speed of the bullet of mass 50g is measured to be 300m/s with an uncertainty of 0.01%. With what accuracy can we locate the position of the bullet if it is measured simultaneously with its speed?

Q3. Show that average kinetic energy of a free electron at 0K is $0.6E_f$.

Q4. Derive an expression for Fermi energy and density of states of the system.

Q5. In what respect semiconductor lasers are different from other type of lasers?

Q6. A glass clad fibre is made with core glass of refractive index 1.5 and the cladding is doped to give a fractional difference of 0.0005. Find the critical internal reflection angle.

Section – C **(10 marks each)**

Q7. Write Schroedinger equation for a particle in a box and determine expression for energy eigen values and eigen functions. Does this predict that the particle can possess zero energy?

Q8. How does light propagate along a fibre? Distinguish between step index and graded index fibres.

Q9. Explain the process of stimulated emission. Obtain a relation in probabilities of spontaneous and stimulated emission.