Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Tech (Only for Electrical Engg.) (2018 Batch) (Sem.–1)

OPTICS & MODERN PHYSICS

Subject Code : BTPH-102-18

Paper ID : [75354]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION - B & C. have FOUR questions each.
3. Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.
4. Select atleast TWO questions from SECTION - B & C.

SECTION-A

1. Write briefly : (2×10=20)

a) What do you mean by standing wave?

b) Write down the equation of wave travelling in the negative direction along x-axis and having an amplitude 0.01 m. a frequency of 5550 Hz and speed 333m/s.

c) Write the necessary conditions for interference to occur.

d) Define resolving power and limit of resolution. What is the relation between them?

e) Explain the term 'total internal reflection'.

f) Explain uncertainty principle.

g) Why the Schrodinger's wave equation is not valid for relativistic particles.

h) What are Fermi energy and Fermi level?

i) Define density of states.

j) What is group velocity and phase velocity.

SECTION-B

2. What is a damped harmonic oscillator? Solve the differential equation and discuss conditions for the over damping, critical damping and under damping action. (8)

3. Derive the relation for the characteristic impedance of a string. Explain the factors on which it depends. (8)

4. a) In a Young's double slit experiment the angular width of a fringe formed on a distant screen is 0.1°. The wavelength of light used 600 nm. What is the spacing between the slits? (3)

   b) Discuss the shape and intensity distribution of fraunhoffer diffraction pattern due to single slit. (5)

5. Discuss the construction, working and energy level diagram of a He-Ne laser. (8)

SECTION-C

6. State Schrodinger's wave equation for a free particle in one dimensional closed box with infinitely hard walls. State the boundary conditions and solve it to obtain the normalized wave function for the particle. (8)

7. Write potential for one dimensional harmonic oscillator and use it to build up a time independent Schrodinger's wave equation. Solve the equation for its eigen energies and eigen wave functions. (8)

8. Explain the salient features of quantum free electron theory. Discuss the Kronig- Pennv model for the motion of an electron in a periodic potential. (8)

9. a) A silicon diode (knee voltage 0.78 V) has a forward current of 100 mA and a reverse current of 1 mA at 50 V. find the value of bulk resistance and reverse resistance. (2)

   b) Derive an expression for the density of electrons (or electron concentration) in the conduction band of an n-type semiconductor. What happens to the Fermi level as the temperature increases? (6)