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

Total No. of Questions : 09

B.Tech.(Electrical Engg.) (2018 Batch) (Sem.–1,2)

OPTICS & MODERN PHYSICS

Subject Code : BTPH-102-18

M.Code : 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) Distinguish between free, damped and forced oscillations.

b) Write the wave equation on a string.

c) Differentiate between Fresnel and Fraunhofer diffraction.

d) Explain working principle of Michelson's interferometer.

e) Write the characteristics of a laser light.

f) What do you understand by Born interpretation of a wave function?

g) Write the characteristics of a well-behaved wave function.

h) Explain the origin of energy bands.

i) Differentiate between intrinsic and extrinsic semiconductors.

j) Explain diffusion and drift in carrier transport.

SECTION-B

2. a) Derive a general differential equation of motion for a simple harmonic oscillator and obtain its solution. (5)

   b) Find the maximum velocity and acceleration of a particle executing S.H.M. of period 10π second and amplitude 5×10^{-2}m. (3)

3. a) Differentiate between progressive, transverse, longitudinal and stationary waves. (4)

   b) Derive the expression for time period of a mass attached to a string. (4)

4. a) Discuss Young's double slit experiment for interference and find the conditions for successive maxima and minima. (6)

   b) Distance between two slits is 0.1mm and the width of the fringes formed on the screen is 5mm. If the distance between the screen and the slit is one meter what would be the wavelength of light used? (2)

5. a) Explain the Einstein's theory of matter radiation interaction and derive the relationship between Einstein's coefficients. (4)

   b) Write a short note on the construction and working of Ruby laser. (4)

SECTION-C

6. a) Derive the expression for time-dependent Schrodinger equation for a wave function. (4)

   b) State and prove Heisenberg Uncertainty principle. (4)

7. a) Using Schrodinger's wave equation, derive the expression for eigen-values of wave function and energy for a particle in a 1-dimensional box. (4)

   b) An electron is constrained to move in a 1-dimensional box of length 0.1 nm. Find the first three energy eigen values and the corresponding deBroglie wave lengths. Given $h = 6.63\times10^{-34}$ Js. (4)

8. a) Discuss free electron theory of metals. (4)

   b) State and explain Bloch's theorem for particles in a periodic potential. (4)

9. a) Explain the dependence of Fermi level on carrier-concentration and temperature. (4)

   b) Describe a p-n junction and its working. (4)

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.