

Roll No.

OLE-3002

B. Tech. 1st Semester (EE)

Examination – April, 2021

WAVES AND OPTICS & QUANTUM MECHANICS

Paper : BSC-PHY-102-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) Define transient and steady state. 1.5
- (b) Differentiate between diffraction and interference. 1.5
- (c) What is wave function ? Give conditions for physically acceptable wave functions. 1.5
- (d) Discuss temporal and spatial coherence. 1.5

- (e) Explain Rayleigh criteria of resolution. 1.5
- (f) Differentiate between ψ and $|\psi|^2$. 1.5
- (g) Define standing waves. 1.5
- (h) Write down the potential function in square well potential. 1.5
- (i) Define quantum dot. Write some of its applications. 1.5
- (j) Defined impedance matching. 1.5

UNIT – I

- 2. Define forced harmonic oscillations. Derive its differential equation and discuss condition of resonance. 15
- 3. Define standing wave. Derive equation for standing wave on a string clamped at both ends. 15

UNIT – II

- 4. (a) Describe construction and working of Michelson Interferometer. How this can be used to find wavelength of given light. 12
- (b) A plano-convex lens of radius 3 m is placed on an optically flat glass plate and is illuminated by monochromatic light. The diameter of 8th bright

ring in the reflected system is $0.72 \times 10^{-2} \text{m}$. Calculate the wavelength of light used. 3

5. (a) What are three and four level lasers? Discuss with suitable diagram principle, construction and working of Nd : Y AG Laser. 12
- (b) Discuss necessary conditions for lasing action. 3

UNIT – III

6. (a) Derive expression for Schrodinger time dependent wave equation in three dimensions. 8
- (b) Discuss Gamow's theory of alpha decay and derive an expression for probability of alpha particle emission. 7
7. (a) Discuss Scanning Tunneling Microscope. 8
- (b) A particle subjected to Dirac Delta potential. Solve Schrodinger wave equation and show that there is only one allowed Eigen value. 7

UNIT – IV

8. Discuss Kronig-Penny model of motion of an electron in a periodic potential. Show from E-K graph that materials can be classified as conductors, insulators and semiconductors. 15