

SECTION - IV

8. (a) Discuss Kroning-Penny model of motion of an electron in a periodic potential. 10  
(b) Define thermal conductivity and specific conductivity. Derive Wiedemann-Franz law. 5
9. (a) What do you mean by diffusion current and drift current? Find expression for total electron density in a semiconductor. 10  
(b) Discuss variation of Fermi level with temperature. 5

Roll No. ....

3002

B. Tech. 2nd Semester (EE)  
Examination - July, 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. Question No. 1 is compulsory. Attempt one question from each Section. All questions carry equal marks.*

1. (a) Define quality factor and resonance. 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) State Heisenberg Uncertainty principle. 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) Distinguish between stimulated emission and spontaneous emission. 1.5

#### SECTION - I

- 2. Define standing wave. Derive equation for standing wave on a string clamped at both ends. 15
- 3. Derive laws of reflection and refraction when an electromagnetic wave is incident obliquely on a boundary separating two different media. 15

#### SECTION - II

- 4. (a) Describe construction and working of Michelson interferometer. How this can be used to find wavelength of given light ? 10

3002- (P-4)(Q-9)(21) (2)

- (b) A shift of 100 circular fringes is observed when movable mirror of Michelson Interferometer is shifted by 0.295 mm. Calculate wavelength of light. 5

- 5. (a) Define diffraction of light. Distinguish between Fresnel and Fraunhofer diffraction. Discuss Fraunhofer diffraction pattern due to single slit and derive expression for width of central maxima. 10
- (b) Discuss the spatial and temporal coherence. 5

#### SECTION - III

- 6. (a) Derive expression for Schrödinger time dependent wave equation in three dimensions. 10
- (b) Prove that group velocity is equal to the velocity of moving particle. 5
- 7. (a) Discuss Scanning Tunneling Microscope. 12
- (b) Out of electron and proton (having same energy), which will easily tunnel through a given potential barrier ? Explain. 3

3002- (P-4)(Q-9)(21) (3)

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