Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 03

Total No. of Questions : 18

B.Tech. (Electrical Engg.) (2018 & Onwards) (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

Write briefly :

Q1. Mention the essential characteristics of a medium supporting the propagation of mechanical waves.

Q2. What do you understand by impedance matching?

Q3. Make a comparison between Fresnel and Fraunhofer diffraction.

Q4. State Huygens's principle.

Q5. Differentiate between spontaneous and stimulated emission.

Q6. State Uncertainty principle and mention its different forms.

Q7. Define Expectation Value.

Q8. What is Born interpretation of probability densities?

Q9. What is the origin of energy bands?

Q10. Differentiate VI characteristics of a p-n junction in forward and reverse bias.

SECTION-B

Q11. a) Explain free vibrations, damped vibrations, forced vibrations and resonance, giving one example of each. 3

b) Discuss the theory of forced harmonic oscillations. How does sharpness of resonance depend on damping? 5

Q12. a) Derive the equation for transverse waves on a string and discuss reflection and transmission of such waves at a boundary. 4

b) Derive the equation for longitudinal waves on a string and discuss reflection and transmission of such waxes at a boundary. 4

Q13. a) Derive the expressions for reflectance and transmittance when an EM plane wave is incident normal at an interface. 5

b) Define these: Fresenel's equations, Brewster's angle and total internal reflection. 3

Q14. a) Explain the construction, working and energy diagram of Ruby laser. 5

b) Make a comparison between solid state lasers and gas lasers in terms of their advantages and limitations. 3

SECTION-C

Q15. Using Uncertainty principle, prove the :

a) Non-existence of electron in the nucleus 4

b) Radius of Bohr's first orbit 4

Q16. a) Solve time-independent Schrodinger wave equation for a linear harmonic oscillator to derive expressions for its eigen functions and eigen-energy values. 5

b) Noamilse the wave function 3

Ψ (x) = 0 outside the box of size 1

Ψ (x) = A sin kx for 0<x<l

Where k= π/1

Q17. a) Using Bloch's theorem write the solutions for a wave function in a periodic potential. 6

b) Write the limitations of free electron theory of metals. 2

Q18. a) Distinguish between metals, semiconductors and insulators on the basis of their energy band diagrams. 3

b) Differentiate between intrinsic and extrinsic semiconductors. 2

c) Discuss the dependence of Fermi level on carrier-concentration and temperature. 3

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.