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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 waves 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: Fresnel'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) Normalise the wave function 3
- $\Psi(x) = 0$ outside the box of size l
- $\Psi(x) = A \sin kx$ for $0 < x < l$
- Where $k = \pi/l$

- 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

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