

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

**UNIT-I**

1. a) Obtain the expression for the diameter of the  $n^{\text{th}}$  dark ring in the case of Newton's rings? 7M
- b) Account for the circular shape of "Newton's Rings" in Interference pattern? 3M
- (OR)**
2. What is diffraction? Explain with necessary theory, the Fraunhofer diffraction due to single slit. 10M

**UNIT-II**

3. a) Define (i) Absorption (ii) Spontaneous Emission (iii) Stimulated Emission (iv) Population inversion 6M
- b) Explain the main components of any laser system. 4M
- (OR)**
4. a) Derive the relation between the probabilities of spontaneous emission and stimulated emission in terms of Einstein's coefficients 8M
- b) Mention applications of laser in the field of medicine? 2M

**UNIT-III**

5. Draw the block diagram of fiber optics communication system and explain the function of each element in system 10M
- (OR)**
6. a) Explain the terms of numerical aperture and acceptance angle of a fiber and derive an expression for them. 6M
- b) The following is the data of an optical fiber,  $n_1 = 1.6$ ,  $n_2 = 1.4$ ,  $n_0 = 1.33$ . Determine its numerical aperture and acceptance angle? 4M

**UNIT-IV**

7. a) Show that the wavelength  $\lambda$  associated with an electron of mass  $m$  and kinetic energy  $E$  is given by  $\lambda = h/\sqrt{2mE}$  5M
- b) What are matter waves? Explain the difference between a Matter wave and electromagnetic wave? 5M

**(OR)**

- |    |    |   |    |
|----|----|---|----|
| 8. | a) | Derive Time independent Schrödinger's wave equation for a free particle | 7M |
|    | b) | State and Explain the Heisenberg uncertainty principle                  | 3M |

### **UNIT-V**

- |             |    |  |    |
|-------------|----|--|----|
| 9.          | a) | Explain the terms of magnetic induction, magnetic flux, vector and scalar fields?                                      | 6M |
|             | b) | Write the integral form of Maxwell equations   | 4M |
| <b>(OR)</b> |    |  |    |
| 10.         | a) | Apply Gauss's law and obtain an expression for magnetic field. What is the conclusion one can draw from the expression | 6M |
|             | b) | Derive the relation between the electric field and electric potential  | 4M |

### **UNIT-VI**

- |             |    |  |     |
|-------------|----|--|-----|
| 11.         |    | Derive an expression for the carrier concentration of an intrinsic semiconductor?  | 10M |
| <b>(OR)</b> |    |  |     |
| 12.         | a) | Show that the for n-type semiconductor the Hall coefficient<br>$R_H = -1/ne$   | 6M  |
|             | b) | In a Hall coefficient experiment, a current of 0.25 A is sent through a metal strip having thickness 0.2 and width 5 mm. The Hall voltage is found to be 0.15 mV when a magnetic of 2000 gauss is used. What is the carrier concentration? | 4M  |

**Time: 3 Hours****Max Marks: 60**

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**UNIT-I**

1. a) What are damped oscillations? Derive the differential equation for damped Harmonic oscillator 6M  
b) Obtain solution for differential equation of Damped harmonic oscillator 4M
- (OR)**
2. a) What are forced oscillations? Obtain an expression for the amplitude of forced oscillations. 6M  
b) Write a short note on resonance and quality factor. 4M

**UNIT-II**

3. a) Explain the principle of superposition of waves. 3M  
b) Derive the expressions for the diameters of the  $n^{\text{th}}$  Dark and Bright Newton's Rings with relevant diagram 7M
- (OR)**
4. a) What is diffraction of light? 2M  
b) Discuss Fraunhofer single slit diffraction. Draw intensity distribution curves and give the conditions for bright and dark fringes in single slit diffraction pattern. 8M

**UNIT-III**

5. a) With the help of suitable diagrams, explain the principle, construction and working of a He-Ne laser. 8M  
b) Mention Merits and demerits of He-Ne laser 2M
- (OR)**
6. a) Describe the Principle of Laser 2M  
b) Derive the relation between the probabilities of spontaneous and stimulated emissions in terms of Einstein coefficients. 8M

**UNIT-IV**

7. a) Define acceptance angle and numerical aperture. 4M  
b) Derive expression for acceptance angle for an optical fiber. How is it related to numerical aperture? 6M
- (OR)**
8. a) Explain the principle behind the functioning of optical fiber. 3M  
b) Describe structure of different types of Optical fibers with ray paths. What are the advantages of optical fiber communication system? 7M

**UNIT-V**

9. a) Explain the terms (i) Lattice (ii) Basis (iii) Crystal Structure, (iv) Atomic Radius, 8M  
b) Give the Coordination Numbers for SC, BCC & FCC systems 2M
- (OR)**
10. a) State the terms (i) Space lattice (ii) basis 2M  
b) What are the seven crystal systems and write the relation between lattice parameters in various crystal systems. 8M

**UNIT-VI**

11. a) Write the properties of dia, para & ferro magnetic materials 6M  
b) Write short note on Hysteresis loop 4M
- (OR)**
12. a) Explain briefly Weiss Theory of Ferromagnetism 6M  
b) Write few applications of superconductors 4M

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**UNIT-I**

1. a) Discuss the ion-exchange process of softening Hard water. 6M  
b) Write a note on Break point chlorination. 4M

**(OR)**

2. a) How can you determine the temporary, permanent and total hardness of water by EDTA method? 6M  
b) What do you mean by sedimentation and coagulation steps in water treatment. 4M

**UNIT-II**

3. a) Discuss about the principle of IR spectroscopy and explain different types of vibrations in IR Spectroscopy. 6M  
b) Define Chemical shift and coupling constant. 4M

**(OR)**

4. a) Explain briefly about absorption shifts in UV- Visible spectroscopy. 6M  
b) Write a note on i) Chromophore ii) Finger print region. 4M

**UNIT-III**

5. a) With a neat Sketch explain Compression and Injection moulding techniques for fabrication of plastic. 6M  
b) Discuss the preparation, properties and uses of PVC polymer. 4M

**(OR)**

6. a) Describe compounding of plastics? Discuss different constituents of compounding and their uses. 6M  
b) Discuss preparation, properties and uses of Bakelite polymer. 4M

**UNIT-IV**

7. a) Explain E1 and E2 reaction mechanisms with examples. 6M  
b) Explain the reaction and mechanism of Claisen rearrangement. 4M

**(OR)**

8. a) Describe Mechanism of Uni molecular and Bi molecular Nucleophilic substitution reactions with examples. 6M  
b) Explain the reaction and mechanism of Pinacol-Pinacolone rearrangement. 4M

**UNIT-V**

9. a) Discuss the theory of Dry corrosion and nature of oxide film formed on the metal surface. 6M  
b) Explain Galvanizing method for the protection of iron from corrosion. 4M

**(OR)**

10. a) Discuss the Electrochemical theory of corrosion. 6M  
b) Write about Impressed current cathodic protection method for controlling corrosion. 4M

**UNIT-VI**

11. a) What is Green chemistry? Explain any four principles of Green chemistry. 6M  
b) What is solar energy? Write briefly about Applications of solar energy. 4M

**(OR)**

12. a) How can you convert solar energy into electricity. Explain. 6M  
b) Write a note on Batteries and super capacitors. 4M