



Shirpur Education Society's
R. C. PATEL INSTITUTE OF TECHNOLOGY, SHIRPUR

An Autonomous Institute

(Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere)



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(स्वायत्त महाविद्यालय)

Programme: B.TECH (ETC)/B.TECH (ELECT)/B.TECH (MECH)/B.TECH (CIVIL)

Year: I/Semester II (Exam Year: 2023-2024)

Subject: Physics

Time: 02:30 pm - 04:30 pm (02:00 Hrs.)

Date: 29 May 2024

Max Marks: 60

END SEMESTER EXAMINATION EVEN SEM-II (2023-2024)

- Instructions: 1. This question paper contains 2 pages 3. Figure in right hand side indicates full marks
2. Draw suitable diagrams wherever required. 4. Assume suitable data wherever required.

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|------|--|---------------------------------------|
| 1. | <p>A. .</p> <p>i. If $\Psi(x,t)$ represents the De-Broglie's wave associated with the moving particle, then derive the Schrodinger time independent equation for matter wave.</p> <p>Give any two reasons how matter wave is different than electromagnetic wave?</p> <p style="text-align: center;">----- OR -----</p> <p>ii. What are phase velocity and group velocity?</p> <p>Prove that the group velocity of De-Broglie's wave associated with a moving particle travel with same velocity as that of particle.</p> <p>Write a short note on quantum computing.</p> | 15
8
8 |
| B. . | <p>i. A particle has mass 1.157×10^{-30} kg and kinetic energy 80 eV. Find the de-Broglie wavelength and group velocity of de-Broglie wave.</p> <p>ii. De-Broglie's wavelength of an electrons in a mono-energetic beam is 7.2×10^{-11} m. Calculate the Momentum and energy of electrons in the beam. Given: $m = 9.1 \times 10^{-31}$ kg, $h = 6.63 \times 10^{-34}$ J.s</p> | 7
4
3 |
| 2. | <p>A. .</p> <p>i. .</p> <p>a. Draw neat, labelled diagram of wedge-shaped thin air film and derive the total path difference as well as conditions for constructive and destructive interference of wedge-shaped film for reflected light.</p> <p>b. What is resolving power of grating. Write the expression for it.</p> <p>ii. .</p> <p style="text-align: center;">----- OR -----</p> <p>a. Why fringes in wedge shaped thin film are straight? Write the conditions of maxima and minima for interference in wedge shaped thin film.</p> <p>b. Explain the formation of double slit diffraction pattern with suitable diagrams. State the expression of the resultant intensity and derive the condition for maxima.</p> | 15
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8
6
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5 |

B. .	7
1. A glass of refractive index 1.4 is to be coated with a transparent material of refractive index 1.3 so that the reflection of light of wavelength 5000\AA is eliminated . What is the required thickness for anti reflection coating?	4
2. A glass of refractive index 1.5 is to be coated with a highly reflective coating to achieve a strong reflection for the wavelength 5500\AA . If the thickness of the coating is 75 nm, calculate the refractive index of coating material.	
ii. The visible spectrum ranges from 4000\AA to 7000\AA . Find the angular separation between the first order visible spectrum of wavelength 4000\AA and 7000\AA produced by a plane grating of lines 6500 lines/cm.	3
3.	15
A. .	8
i. .	8
a. Explain the spontaneous and stimulated emission with diagram. Which of them is involved in laser action and why?	6
b. Define step index and graded index optical fiber	2
----- OR -----	
ii. .	8
a. What is population inversion? How it is achieved? List four methods of pumping in laser.	4
b. Explain the basic principle of an optical fiber with proper diagram?	4
B. .	7
i. An optical fibre has a numerical aperture of 0.15 in air and a cladding refractive index of 1.50. Find the numerical aperture of the fibre in liquid of refractive index 1.30. Also find core refractive index of fibre.	4
ii. Define the terms: a) Active system, b) Metastable state, c) Life time	3
4.	15
A. .	10
i. .	10
a. Write the four Maxwell's equations in integral form. State physical significance of Maxwell's first equation.	6
b. Given, vector function $\vec{W} = x^3yz\vec{i} + y^2z^3\vec{j} + 4y^2z^3\vec{k}$. Verify whether the field is solenoidal or not.	4
----- OR -----	
ii. .	10
a. State divergence theorem and Stokes' theorem along with the mathematical expressions. State physical significance of divergence theorem and Stokes' theorem	6
b. Find the gradient of $\Phi(x, y, z) = 2x^2y - 5y^3z^2 + 4x^2yz$ at point (1, -2, 1)	4
B. . What is IR sensor. State any four applications of IR sensors	5