



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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Programme: B.TECH (AIML)/B.TECH (COMP) /BTECH (CSEDs)
Year: I/Semester I (Exam Year: 2023-2024)

Subject: Physics

Time: 08:00 am - 10:00 am (02:00 Hrs.)

Date: 16 Mar 2024

RE END SEMESTER EXAMINATION ODD SEM -I March 2024

Max Marks: 60

Instructions:

1. This question paper contains 4 pages
2. Answer to each new question to be started on a fresh page.
3. Figure in right hand side indicates full marks
4. All Questions are Compulsory.
5. Assume suitable data wherever required.
6. Support your answers with neat labelled diagrams, wherever necessary.

1. 15
- A. 8
 - i. Explain the physical significance of wavefunction. Derive Schrodinger time dependent wave equation. 8

----- OR -----

 - ii. State the deBroglie hypothesis of matter waves. Derive an expression for deBroglie wavelength of matter waves and state it in its three different forms. 8

Compare the deBroglie wavelengths of a fast-moving cricket ball with an accelerated electron moving at relativistic speed.
- B. 7
 - i. The energy of an electron is 1 KeV calculate its momentum. If position is located within 12 nm then calculate the uncertainty in its momentum? Given: Mass of electron is 9.1×10^{-31} Kg, $h=6.63 \times 10^{-34}$ Js. 4
 - ii. Calculate the wavelength of the wave associated with a neutron moving with energy 0.03 eV 3

Given: mass of neutron is 1.676×10^{-27} Kg, $h=6.63 \times 10^{-34}$ Js.
2. 15
- A. 8
 - i. 8
 - a. Define fringe width and derive its expression for a wedge shaped thin film. Write the expression to determine the thickness of a paper using wedge shaped film. 6
 - b. Define Dispersive power of grating. Write the expression for it. 2
 - ii. 8

----- OR -----

 - a. Why does the interference pattern observed in reflected light is well-defined while in transmitted it is not so well-defined for a thin film? 3

b. Discuss briefly the absent spectra and derive an expression for missing orders in diffraction. Find the missing orders for a double slit when the slit width is equal to ruled spacing.	5
B.	7
i. Light of wavelength 5500 \AA , falls normally on a thin wedge-shaped film of refractive index 1.4 forming fringes that are 2.5 mm apart. Find the angle of wedge in seconds.	4
ii. Visible light of wavelength 550 nm falls on a single slit and produces its second diffraction minimum at an angle of 45° with respect to its incident direction.	3
1. Calculate the width of the slit.	
2. Find the angle at which the first minima is observed.	
3.	15
A.	8
i.	8
a. Derive Einstein's relation for absorption, stimulated and spontaneous emission. Why is it difficult to fabricate lasers in the X-ray region?	6
b. Explain the working principle of optical fibre with diagram.	2
----- OR -----	
ii.	8
a. Differentiate between spontaneous and stimulated emission of light.	4
b. Draw the block diagram of an optical fibre communication system and explain the function of each block.	4
B.	7
i. A step index fiber is made with core of refractive index 1.52 and diameter 29 \mu m and cladding refractive index of 1.5189. If it is operated at wavelength 1.3 \mu m , find V number of the fibre and number of modes it will support.	4
ii. Compare the merits and demerits of He-Ne and Nd-YAG lasers.	3
4.	15
A.	8
i.	8
a. Derive Maxwell's second equation and state its significance.	4
b. Find the thickness of the quartz plate needed to produce ultrasonic waves of frequency 3.8 MHz and 300 KHz. Given the density of quartz = 2650 kg/m^3 and Youngs Modulus = $8 \times 10^{10} \text{ N/m}^2$	4
----- OR -----	
ii.	8
a. State the divergence theorem with significance and write its mathematical expression.	4
b. Write a short note on LDR. State any four specific applications.	4
B.	7
i. If $\vec{V} = xy^2\vec{i} + 2yx^2z\vec{j} - 3yz^2\vec{k}$ is a vector function. Compute curl \vec{V} at a point (1,-1,1)	4
ii. If $\vec{A} = 2x^3y\vec{i} + 2y^2z^3\vec{j} - 3xyz^2\vec{k}$. Find the div at point (1, 1,-1)	3