Shirpur Education Society's
R. C. PATEL INSTITUTE OF TECHNOLOGY, SHIRPUR
An Autonomous Institute
(Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere)

आर. सी. पटेल इन्स्टिट्यूट ऑफ टेक्नॉलॉजी, शिरपूर
(स्वायत्त महाविद्यालय)

Programme: B.TECH (AIDS)/B.TECH (AIML)/B.TECH (EXTC)/B.TECH (IOT)/B.TECH (MECH)

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

Subject: Physics

Date: 09 Jan 2024

Max Marks: 60

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

END SEMESTER EXAMINATION ODD SEM- I(Acad. Year: **2023-2024**)

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. 1		**15**
A.		**8**
	i. Define Phase velocity and state the related formulas.	**8**

Define Qubit. Differentiate between quantum computer and classical computer. (4 points)

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ii. State Heisenberg's uncertainty principle. Express it in different forms. **8**

Why is the wave nature of matter not more apparent in our daily life?

Explain that a group of waves rather than a single wave is associated with matter.

B. **7**

i. Calculate the lowest three energy states of neutron confined in potential well of width 10 A°. Given the mass of neutron is 1.67×10^{-27} Kg and h = 6.63×10^{-34} Js. **4**

ii. A fast-moving neutron has de-Broglie wavelength 2×10^{-12} m. Calculate the group velocity and phase velocity associated with it. Given: mass of neutron is 1.67×10^{-27} Kg, h=6.63×10^{-34} Js. **3**

2. 2		**15**
A.		**8**
i.		**8**

a. Discuss the formation of interference fringes due to wedge shaped thin film. Derive the path difference and conditions for brightness and darkness in reflected light due to wedge shaped film. **6**

b. Define Diffraction grating. State the relation between the grating element and the number of rulings on grating. **2**

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ii. **8**

a. State the differences between the Newton's rings interference pattern and wedge shaped film interference pattern formed in reflected light. (3 points) **3**

b. Derive the expression for resultant amplitude in diffraction due to N slits using phasor diagram. Write the grating equation. **5**

B. **7**

  i. Light falls normally on a soap film of thickness 5×10^{-5} cm and of refractive index 1.33. Which wavelength in the visible region (4000 Å - 7500 Å) will be reflected most strongly? **4**

  ii. A monochromatic light of wavelength 6580 Å falls normally on a grating 2 cm wide. The first order spectrum is produced at an angle of $18^{o}14$' from the incident direction. Calculate the total number of lines on the grating? **3**

3. 3 **15**

A. **8**

 i. **8**

  a. Explain with a neat, labelled diagram the construction and working of the He Ne laser, along with the energy levels. **6**

  b. State the types of optical fibres based on refractive index profile. **2**

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 ii. **8**

  a. Explain diagrammatically the three level and four level LASER system. **4**

  b. What are the advantages of optical fiber over conventional means of communications. **4**

B. **7**

  i. A glass clad fibre is made with core of refractive index 1.5 and the cladding is doped to give a fractional index difference of 0.0005.
Calculate:
(a) The cladding refractive index
(b) The critical angle
(c) The acceptance angle
(d) The numerical aperture. **4**

  ii. What is the acronym for LASER? Why are gas lasers more monochromatic than solid-state lasers? **3**

4. 4 **15**

A. **8**

 i. **8**

  a. Derive Maxwell's first equation and state its significance. **4**

  b. Explain in detail the principle behind the generation of ultrasonic waves. State any three specific applications of ultrasonic waves. **4**

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 ii. **8**

  a. State Stokes' theorem with significance and write its mathematical expression. **4**

  b. Write a short note on photodiode sensor. State any four specific applications. **4**

B.

7

i. If $\vec{F} = x^3 y\,\vec{i} - (z^2 - 5x)\,\vec{j} + 7y^2\,\vec{k}$ is a vector function. Calculate the divergence and curl of $\vec{F}$.

4

ii. Find divergence at a point $(1,1,2)$ of a function $\vec{V} = 3xy^3\,\vec{i} + 7z^2\,\vec{j} - 4y^2\vec{k}$

3