

Time: 2 Hours

Maximum Marks: 60

- i Question number 1 is compulsory
- ii Attempt any three questions from Q2 to Q6
- iii Assume suitable data wherever required
- iv Figures to the right indicate full marks for that question

QN	Question	Marks
<b>Q1</b>	<b>Attempt any five out of six (3 marks each)</b>	<b>15</b>
<b>A</b>	What do you mean by resolving power of diffraction grating ? What is its significance ?	
<b>B</b>	What is population inversion in Laser system ? What is its Significance ?	
<b>C</b>	An optical fibre refractive index 1.48 and 1.41 respectively of core ,clad Calculate i) Critical angle ii) Numerical Aperture iii) Maximum Incidence angle	
<b>D</b>	Find the divergence of a Vector field $\vec{F} = 4x \hat{i} + 2y \hat{j} + 3z \hat{k}$	
<b>E</b>	Calculate the velocity of a particle at which it should move so that its mass will increase by 25% of its rest mass.	
<b>F</b>	What are nanomaterials & what are their different types	
<b>Q2</b>	<b>Attempt all questions</b>	<b>15</b>
<b>A</b>	What is plane transmission Grating ? Explain its spectral response A plane transmission Grating has 5000 lines/cm. i) Determine the Highest order of spectrum observed if incident light is having wavelength of 6010 Å ii) If the opaque spaces between the slits are made three times the transparent space and the maximum order is three , Find which order of spectra will be absent .	<b>8</b>
<b>B</b>	With neat and labelled diagrams explain the construction and working of a Nd-Yag laser.	<b>7</b>

**Q3 Attempt all questions 15**

- A** What are Galilean transformations? Obtain transformation equations for coordinate, velocity and acceleration. **8**
- B** Explain the term ‘curl of a vector and state its significance’. Show that the divergence of the curl of a vector is zero. **7**

**Q4 Attempt all three questions (5 marks each) 15**

- A** What do you understand by resolving power? How can the resolving power of a grating be increased? Find maximum resolving power of a grating of width 3 cm, illuminated by a laser beam of wavelength  $6000 \text{ \AA}$  having 6000 lines per cm.
- B** What is the divergence of a vector field? Find the divergence of a field  $F = xz \hat{i} + y^2z^3 \hat{j} - xyz \hat{k}$  at a point (3, -1,2). Interpret the result you obtain.
- C** With a neat labelled diagram explaining the construction and working of an Scanning electron microscope. (SEM)

**Q5 Attempt all three questions (5 marks each) 15**

- A** Obtain Ampere’s circuital law for static magnetic field in differential and integral form
- B** What is time dilation? Express it mathematically. The length of a moving rod is found to be one fourth of its length when at rest. What is the speed of the rod relative to the observer?
- C** What is Holography ? With neat diagram explain reconstruction process of a hologram.

**Q6 Attempt three questions (5 marks each) 15**

**Write short Notes on**

- A** Application of fibre optics in communication
- B** Applications of Nano technology in various fields
- C** Applications of Lasers in industry

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