

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>	How the condition, for absent spectra in a grating, is obtained?	
<b>B</b>	Draw and explain energy level diagram for He:Ne laser. What is the role of helium atoms?	
<b>C</b>	With the help of a diagram define the term acceptance angle.	
<b>D</b>	If $\phi(x,y,z) = 3x^2y - y^3z^2$ , Find $\vec{\nabla}\phi$ at the point (-1, -2, 1).	
<b>E</b>	Calculate the velocity of a particle having kinetic energy 3 times its rest mass energy.	
<b>F</b>	Explain, with an example, the significance of surface area to volume ratio in nanotechnology.	
<b>Q2</b>	<b>Attempt all questions</b>	<b>15</b>
<b>A</b>	Discuss with appropriate diagram the phenomenon of Fraunhofer diffraction at a single slit and write the conditions for its maxima and minima.	<b>8</b>
<b>B</b>	With neat and labelled diagrams explain the construction and working of a semiconductor laser. Give its application.	<b>7</b>
<b>Q3</b>	<b>Attempt all questions</b>	<b>15</b>
<b>A</b>	Discuss the phenomenon of Fraunhofer's diffraction at a single slit and obtain the condition for the first minimum.	<b>8</b>
<b>B</b>	What are scalar and vector fields? How is a del operator expressed? Explain the term 'curl of a vector and state its significance'. Show that the divergence of the curl of a vector is zero.	<b>7</b>

- 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 7 cm, illuminated by a laser beam of wavelength  $4800 \text{ \AA}$  having 000 lines per cm.
- B**    State and derive maxwell's equation which describes how the electric field circulates around the time varying magnetic field (Differential form).
- C**    A step index fiber has a core diameter of  $33 \times 10^{-6} \text{ m}$ . the refractive indices of core and cladding are 1.56 And 1.5189 respectively. If the light of wavelength  $1.3 \text{ \mu m}$  is transmitted through the fiber, Determine normalized frequency of the fiber. Weather fiber supports single mode or multimode.
- 
- Q5**                      **Attempt all three questions (5 marks each)**                      **15**
- A**    Explain Gauss's laws for static electric and static magnetic fields in differential and integral forms.
- B**    Explain the concept of relativity. Comment on Galilean and lorentz Transformations
- C**    What is nano material? Explain any one method of production of nano material.
- 
- Q6**                      **Attempt all three questions (5 marks each)**                      **15**
- A**    State and explain application of optical fibre with suitable example
- B**    Explain construction and working of Atomic force Microscope
- C**    What is Time dilation and space contraction using Lorentz transformations obtain expression for them.

\*\*\*\*\*