

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
Q1	Attempt any five out of six (3 marks each)	15
A	How the condition, for absent spectra in a grating, is obtained?	
B	Draw and explain energy level diagram for He:Ne laser. What is the role of helium atoms?	
C	With the help of a diagram define the term acceptance angle.	
D	If $\phi(x,y,z) = 3x^2y - y^3z^2$, Find $\vec{\nabla}\phi$ at the point (-1, -2, 1).	
E	Calculate the velocity of a particle having kinetic energy 3 times its rest mass energy.	
F	Explain, with an example, the significance of surface area to volume ratio in nanotechnology.	
Q2	Attempt all questions	15
A	Discuss with appropriate diagram the phenomenon of Fraunhofer diffraction at a single slit and write the conditions for its maxima and minima.	8
B	With neat and labelled diagrams explain the construction and working of a semiconductor laser. Give its application.	7
Q3	Attempt all questions	15
A	Discuss the phenomenon of Fraunhofer's diffraction at a single slit and obtain the condition for the first minimum.	8
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.	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 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 $1.3 \text{ }\mu\text{m}$ is transmitted through the fiber, Determine normalized frequency of the fiber. Weather fiber supports single mode or multimode.
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- 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.
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- 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.
