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 Å° 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 $x10^{-6}$ m. the refractive indices of core and cladding are 1.56 And 1.5189 respectively. If the light of wavelength 1.3 µm 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.

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