

19/6/2023

Maximum Marks: 60

Time: 2 Hours

- 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 \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 \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.
