

[Time: 2 Hours]

[Marks: 60]

- N.B. 1) Question no. 1 is compulsory  
 2) Solve any 3 questions from question no. 2 to 6.  
 3) Assume suitable data wherever required.  
 4) Figures to right indicate full marks.



Q.1. Solve any five from the following. (15M)

- Explain how interference in wedge shaped film is used to test optical flatness of given glass plate.
- What is diffraction grating? What is the advantage of increasing the number of lines in the grating?
- With neat ray diagram explain the concept of total internal reflection (TIR).
- Differentiate between spontaneous and stimulated emission.
- Find cylindrical coordinates of a point  $(3\vec{i}+4\vec{j}+\vec{k})$ .
- In Newton's rings pattern what will be the order of the dark ring which will have double the diameter of the 40<sup>th</sup> dark ring.
- Draw the block diagram of cathode ray tube (CRT) and briefly explain functions of its parts.

Q.2

- Derive the conditions for maxima and minima due to interference of light reflected from thin film of uniform thickness. (8M)
- Derive the formula for numerical aperture of step index fibre and give its physical significance. The N.A. of an optical fibre is 0.5 and core refractive index is 1.54. Find the refractive index of cladding. (7M)

Q.3

- Discuss the Fraunhofer diffraction at single slit and obtain the condition for minima. In plane transmission grating the angle of diffraction for second order principal maxima for wavelength  $5 \times 10^{-5}$  cm is  $35^\circ$ . Calculate number of lines /cm on diffraction grating. (8M)
- What is the difference between photography and holography? Explain holography technique to obtain 3-D image of an object. (7M)

Q.4

- Find the divergence of vector field  $\vec{F} = x^2yz\vec{i} + xz\vec{j}$  (5M)
- Explain how A.C. voltage and its frequency is measured using CRO. (5M)
- A wedge shaped air film having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between consecutive bright fringes is 0.12 cm. Calculate wavelength of light used. (5M)

Q.5

- a) Explain Newton's rings experiment and show that diameters of  $n^{\text{th}}$  dark rings are proportional to square root of natural numbers. (5M)
- b) Write Maxwell's equations and give its physical significance. (5M)
- c) Explain construction and working of atomic force microscope. (5M)

Q.6

- a) Explain different types of carbon nanotubes and give its applications. (5M)
- b) Explain construction and working of Nd:YAG laser. (5M)
- c) Write a note on electrostatic focussing. (5M)
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