Duration: 2Hr 30Min   **Marks 75**

N.B. All Questions are compulsory.

Figures on the right indicate marks.

Symbols have usual meanings.

Q.1 A Attempt any Two.   16

i   Explain Fresnel diffraction from a straight edge and obtain the expression for

optical path difference $\delta = \dfrac{x^2 a}{2b(a+b)}$.

ii   Give account of Fresnel type of diffraction effect produced by a narrow rectangular slit .Explain if a point is near the geometrical shadow.

iii   Distinguish between the prism spectra and grating spectra.

iv   Explain intensity distribution on the screen when a monochromatic light normally illuminates the plane transmission grating. Give equation for grating law.

B Attempt any One.   4

i   State Fresnel assumptions for the diffraction phenomena with diagram.

ii   Determine the number of lines in 1cm of the grating surface when a plane transmission grating diffracts second order through $30°$ for incident light of wavelength $5000A^o$.

Q.2 A Attempt any Two.   16

i   Write a short note on construction and working of Michelson interferometer

ii   Explain the principle and working of Fabry-Perot interferometer

iii   Deduce an expression for the resolving power of a prism. Show that it is independent of the angle of prism.

iv   Drive an expression for the resolving power of the diffraction grating.

B Attempt any One.   4

i   Explain how to determine the refractive index of gases by using Michelson Interferometer.

ii   Explain Rayleigh's criterion. What is meant by "Resolving power of an optical instrument"?

Q.3 A Attempt any Two.   16

i   State Brewster's Law and obtain the expression for it.

ii   Two linearly polarized electromagnetic waves moving along Z axis such that

P.T.O.

their electric field vectors are along X axis are given by ,

$E_1 = \hat{i}\, a_1 \cos(kz - \omega t + \theta_1)$ and $E_2 = \hat{i}\, a_2 \cos(kz - \omega t + \theta_2)$ .Find the resultant of the superposition of the waves.

iii   .Discuss the different methods of obtaining the plane polarized light.

iv   With the help of suitable diagram explain the Malus Law.

B   **Attempt any One.**   4

i   Quartz crystal has refractive indices 1.553 and 1.544 for extra ordinary and ordinary ray respectively. Find the thickness of the quarter wave plate for light of wavelength $5890 A^0$.

ii   If refractive index of a certain material is 1.33 find the polarizing angle.

Q.4 A   **Attempt any Three**   15

i   Explain Fraunhoffer diffraction from a single slit.

ii   A cylindrical wire of **0.05 cm** diameter is placed in front of a slit illuminated by light of wavelength **6000 A^0**, find the width of a band on the screen at a distance of **100 cm** from the wire.

iii   Explain how the wavelength of a monochromatic source is determined by using Michelson Interferometer.

iv   Explain how the Fabry-Perot interferometer is used to compare the two wavelengths.

v   Explain the terms plane polarized light, circularly polarized light, elliptically polarized light and unpolarised light.

vi   What is double refraction? Explain the terms positive crystal and negative crystal.

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