BIT Sindri
1st Mid-term examination – 2019
Semester 2 (First year)
Branch – Chemical Engineering
Paper – Physics II
(Optics and Fiber optics)

Time –1 $\frac{1}{2}$ hours **Full Marks : 20**

Answer five questions from group A and group B. Group A is compulsory.

Group A (Multiple choice questions)

Answer any four questions **1X4 = 4**

Q.1

(i) Which of the following is conserved when light waves interfere?
(a) Intensity (b) Energy (c) Amplitude (d) Momentum

(ii) For constructive interference to take place between two monochromatic light waves of wavelength λ, the path difference should be
(a) $(2n-1)\frac{\lambda}{4}$ (b) $(2n-1)\frac{\lambda}{2}$ (c) $n\lambda$ (d) $(2n+1)\frac{\lambda}{2}$

(iii) When a drop of oil is spread on the surface of water, it displays beautiful colours in day light because of
(a) Dispersion of light (b) Reflection of light (c) Polarization of light (d) Interference of light

(iv) The penetration of light into the geometrical shadow is called
(a) Polarization (b) Interference (c) Diffraction (d) Reflection

(v) The condition for obtaining Fraunhofer diffraction from a single slit is that the light wavefront incident on the slit should be
(a) Spherical (b) Cylindrical (c) Elliptical (d) Planar

(vi) To obtain diffraction, the size of an obstacle
(a) should be of the same order as wavelength (b) should be much larger than the wavelength
(c) has no relation to wavelength (d) should be exactly λ/2

Group B (Long answer questions)

Answer any four questions **4X4 = 16**

Q.2 Derive an expression for the resultant intensity at a point due to superposition of two light waves. Find the conditions for maximum intensity and minimum intensity. Draw and explain intensity distribution curve.

Q.3 Discuss the effect of introducing a thin mica sheet in the path of one of the interfering beams in a biprism experiment. Deduce an expression for the displacement of the fringes. How this method is used for finding the thickness of a thin glass plate?

Q.4 Describe and explain the formation of Newton's rings in reflected monochromatic light. Prove that in reflected light (1) diameters of bright rings are proportional to the square roots of odd natural numbers and (2) the diameters of dark rings are proportional to square roots of natural numbers.

Q.5 Describe Fraunhofer diffraction due to a single slit and deduce the positions of maxima and minima.

Q.6 Describe the diffraction pattern due to Fraunhofer diffraction at two slits. Deduce the expression for the intensity and explain it mathematically. Differentiate the diffraction patters of one slit and two slits.

Q.7 Describe the construction and principle of a plane transmission grating. Obtain expression for intensity distribution. Deduce conditions for the principal maxima and minima.

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