B.Sc.(Honours)Examination, 2018

Semester–V

Physics (Honours)

Course: BPC-54

(Physical Optics)

Time: Three Hours **Full Marks: 40**

Questions are of value as indicated in the margin.

Answer***anyfour*** questions

1. (a)What is Rayleigh criterion of resolution? 2

(b)Show that there is a phase change of π when light gets reflected from the surface of an optically denser medium. 2

(c)Show that in case of Newton's ring interference pattern, the diameters of dark rings are proportional to the square root of the natural numbers; whereas that of bright rings are proportional to the square root of odd natural numbers. 2+2

(d) In Newton's ring experiment, the diameter of the m^{th} and $(m+12)^{th}$ bright rings are 10 mm and 12 mm respectively. Find the wavelength of light source used in the experiment. Given: the radius of curvature of the lower surface of the lens is 3 meter. 2

2.(a) Apply Huygen's principle of wave propagation to deduce the relation for refraction of spherical wave at a concave spherical surface. 4

(b)How would you get an estimate of the coherent length of the light source used in an experiment using Michelson Interferometer? 2

(c)A quasi-monochromatic light source emits radiations of mean wavelength 660 nm and has a band-width of 10^9 Hz. Find the coherent length and monochromaticity. 1+1

(d)What are the basic conditions for observing a good and sustained interference pattern? 2

3.(a) What are the differences between Fresnel and Fraunhofer types of diffraction? 2

(b) Show that in Fraunhofer diffraction at a single slit, the intensities of successive maxima are nearly in the ratio:

$4/9\pi^2 : 4/25\pi^2 : 4/49\pi^2$ 7

(c) What is missing order in the case of Fraunhofer diffraction in a double slit? 1

4.(a) What is Malus's law? 1

(b)Define the terms: (i) plane of vibration (ii) plane of polarization 0.5+0.5

(c)Draw a representative diagram showing the propagation of a plane wave incident normally on a negative uniaxial crystal. 2

(d) Distinguish between the action of a quarter wave-plate and half wave-plate. 2

(e) Draw the schematic view of an experimental set up for the measurement of optical activity of a substance. 2

(f) What are the basic assumptions of Fresnel's theory of rotatory polarization? 2

5.(a)Consider that light gets diffracted through 5 numbers of slits. Draw the necessary graph showing the intensity distribution pattern. 2

(b)Distinguish positive and negative zone plate. 2

(c)Show that the amplitude due to a large wavefront at a point in front of it is just half that due to the first half-period zone. 3

(d)Show that a zone plate has multiple foci. 3

P.T.O.

6.(a) What are the limitations of plane diffraction grating? 2

(b)Derive the standard expression for the angular dispersive power of reflection type of Echelon grating. 3

(c)Find the order number and the resolving power of a reflection type of Echelon grating having 30 plates, each of thickness 1.2 cm and illuminated by light of wavelength 2537 A°. 1.5+1.5

(d)Discuss the effect of increasing slit width and increasing slit separation on the quality Fraunhofer diffraction pattern in double slit. 1+1

7.(a) In a bi-prism experiment, the fringe width is found to be 0.431 mm with the use of a light source having wavelength 5.89×10^{-5} cm. On introducing a mica sheet (having refractive index 1.59) in the path of one of the interfering beams, the central fringe shifts by 1.89 mm. Calculate the thickness of the sheet. 3

(b) "Spacing of dark as well as bright bands decreases with the increase of order number of the bands." – Establish the statement in case of Fresnel diffraction at a straight edge. 5

(c) Show, by Brewster's law, that light incident on a transparent substance at polarizing angle gives reflected and refracted rays at right angles to each other. 2

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