UG Odd Semester Examination, 2022

EDUCATION B.Sc. B.Ed

(3rd Semester)

Course No.: BSPH-302

(Physical Optics)

Full Marks: 50

Pass Marks: 20

Time: 2 hours

The figures in the right margin indicate full marks for the question.
Answer the following five (5) questions

1. (a) Derive the equation representing the shape of the fringes of the double-slit experiment. And hence explain why we obtain approximately straight line fringes on the screen. 5

   (b) Using analytical method derive the expression for the intensity of the interference pattern

   $$I = I_1 + I_2 + 2\sqrt{I_1}\sqrt{I_2}\cos\delta$$ 5

   where δ is the phase difference. Also deduce

   $$\frac{I_{max}}{I_{min}} = \frac{(\sqrt{I_1} + \sqrt{I_2})^2}{(\sqrt{I_1} - \sqrt{I_2})^2}$$

   Or

2. Obtain the conditions of bright and dark fringes of interference pattern due to division of amplitude of light in transparent parallel thin film with a neat labelled diagram. 2+8=10

3. Describe the construction and working of Michelson interferometer with a neat labelled diagram. Also show that the fringes become less closely spaced when the separation between two mirrors M_1 and M_2 is decreased. 8+2=10

Or

4. (a) How Michelson interferometer is used to determine the difference in wavelength between two closely spaced spectral lines? 5

(b) Explain how the Michelson interferometer can be used to measure the wavelength of a monochromatic light. 3

(c) What is the role of compensating glass plate in Michelson interferometer? 2

5. (a) Obtain the positions of minima and maxima diffraction pattern of a single slit diffraction experiment. Also show that the intensity of the first maximum is 4.96% of the central maximum. 5+1=6

(b) Draw a neat labelled diagram showing the amplitude and intensity distribution of single slit diffraction pattern. 2

(c) Draw the intensity distribution of diffraction pattern due to a circular aperature. 2

Or

6. (a) What are Fresnel's assumptions of diffraction of light? 3

(b) Discuss how the Fresnel's half-period zones are constructed. Also show that the area of each half-period zone of a plane wavefront is equal and radii of half-period zones are proportional to the square root of the natural number. 3+4=7

7. (a) Show that the intensity of light transmitted through a polarizer is $I_{0/2}$. Where I_0 is the intensity of light incident on the polarizer. 5

(b) Describe the construction and working of a Nicol prison with a neat labelled diagram. 5

Or

8. (a) What is double refraction? 1

(b) Describe analytically how circularly and elliptically polarized light wave are produced when a plane polarized light is incident on a calcite crystal. 9

9. (a) Write the principle of laser. 5

(b) Describe the construction and working of ruby laser. 5

Or

10. (a) Explain how an optical fibre guides the light beam. 4

(b) Draw the distribution of refractive index of an optical fibre. 2

(c) What is the importance of cladding of optical fiber? 3

(d) Define numerical aperature of an optical fibre. 1

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