UG Odd Semester Examination, 2022

EDUCATION B.Sc. B.Ed

(5th Semester)

Course No.: BSPP-502

(Waves, Oscillations and 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 differential equation for simple harmonic motion. And obtain the velocity and acceleration of a particle executing simple harmonic motion if its position at time t is given by $x = A\sin\omega t$. 2+2=4

   (b) Show that total energy of the oscilating particle is $E=\frac{1}{2}m\omega^2A^2$. And calculate the displacement to amplitude ratio for the particle if the K.E. is 90% of total energy. 6

Or

2. (a) What is Lissajous figure? 1

   (b) Describe analytical how the Lissajous figures :

   (i) Straight line with positive slope.

   (ii) Symmetrical ellipse

   (iii) Circle

are formed when the two perpendicular harmonic oscillations superpose. 9

3. (a) State Fermat's principle. Deduce Snell's law of refraction of light using Fermat's principle. 1+4=5

(b) Derive the equivalent power of the combination of the two given lenses given by the relation

$P = P_1 + P_2 = dP_1P_2$

where d is the separation between two lenses. 5

Or

4. (a) Show that the longitudinal chromatic aberration is given by

$f_r - f_\upsilon = \omega f$ where ω is dispervise power. 5

(b) Find the condition of achromatism of two lenses separated by some distance 'd'. 5

5. (a) Explain briefly about the interference of light. 2

(b) Show that the width of the fringe in Young's double-slit experiment is $\beta = \frac{\lambda D}{d}$. The symbols have their usual meanings. 8

Or

6. (a) Show that the intensity of interference pattern produced by two light waves of intensities I_1 and I_2 is

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

where δ is phase difference, also deduce

$I_{max} = (\sqrt{I_1} + \sqrt{I_2})^2$ and $I_{min} = (\sqrt{I_1} - \sqrt{I_2})^2$. 8

(b) If $I_1 = I_2 = I_0$ then show that 2

$I = 4I_0 \cos 2(\delta/_2)$

7. (a) Write Frernel's assumptions of diffraction. 2

(b) Show that the radius of half-period zone is proportional to the square root of natural number. 8

Or

8. (a) What is Fraunhoffer diffraction? 1

(b) Derive the expression for the width of central maximum in Fraunhoffer diffraction due to a single slit. 9

9. (a) Write any two applications of polarization. 2

(b) What are the differences between E and O-rays of light wave? 3

(c) State and prove Brewster's law of polarization of light. 5

Or

10. (a) Draw a neat labelled diagram of Nicol prism. 2

(b) If I_0 is the intensity of the incident unpolarised light on a polarizer show that the intensity of transmitted light is $\frac{I_0}{2}$. 8

****