This question paper contains 2 printed pages. *Your Roll No. .....*

Sl. No. Of Ques. Paper	:	**8338 C**
Unique Paper Code	:	**222363**
Name of the Paper	:	**PHPT-303 : Physics – III Waves and Optics**
Name of the Course	:	**B.Sc. Physical Science / App. Physical Science Part II**
Semester	:	**III**
Duration	:	**3 hours**
Maximum Marks	:	**75**

Attempt any five questions. All questions carry equal marks.

1. (a) Derive the general equation of motion resulting from the superposition of two simple harmonic motions progressing perpendicular to each other in a plane and having same frequency. What will be the shape of the resultant motion for oscillations if their amplitudes are equal but having initial phase difference of $\pi/2$ with each other? **(7,3)**

   (b) A particle under simple harmonic oscillation has time period 2 second and amplitude 5 cm. Calculate its maximum kinetic energy. Can it's maximum potential energy be more than its maximum kinetic energy? Give proper justification. **(3,2)**

2. (a) Obtain the equation of motion of a damped harmonic oscillator having one degree of freedom. Also derive its general solution. **(6,4)**

   (b) Define logarithmic decrement, relaxation time and quality factor. Obtain a relation between them. **(5)**

3. (a) Two identical simple pendulums of same mass 'm' and length 'l' are coupled by linear spring of force constant 'k'. Obtain normal co-ordinates and normal modes of their motion. **(10)**

   (b) How will you distinguish forced oscillations from the coupled oscillations. **(5)**

4. (a) Obtain the differential equation of motion of forced harmonic oscillator, mentioning the various forces involved in the motion. Obtain the steady state solution of the equation. **(10)**

   (b) Stationary wave is set up by two plane progressive waves given as

   $$y_1 = a \sin(8\pi t - x)$$
   $$y_2 = a \sin(8\pi t + x)$$

   Here 'a' is amplitude. Find the equation of stationary wave and calculate its maximum and minimum amplitudes. Also calculate frequency. **(5)**

5. (a) Derive the expression for diameter of the Newton's ring pattern for reflected mode. How can wavelength of monochromatic light be determined by this method? **(10)**

(b) Newton rings are formed in reflected mode by monochromatic light of wavelength 6000 Å with a combination of plane glass plate and a plano-convex lens of radius of curvature 1.2 m. Calculate the diameters of 7^{th} dark ring and 5^{th} bright ring. **(5)**

6. (a) Derive an expression for the intensity of light on the screen due to Fraunhofer diffraction produced by a single slit and discuss intensity and position for principal and secondary maxima. Draw the graph between intensity and path difference of various points on the screen. **(7,3)**

(b) Fraunhofer diffraction pattern is obtained by a single slit of width 0.1 mm, when it is illuminated by monochromatic light of wavelength λ=5000 Å. If diffraction pattern is obtained at a distance of 1 m from slit, calculate the width of central maximum. **(5)**

7. (a) Using the theory of Fresnel Half Period Zones, show that light travels in straight line. **(10)**

(b) How is a zone plate different from a convex lens? **(5)**

8. (a) State Rayleigh criterion of resolution of two close points. **(3)**

(b) What is double refraction? Define ordinary ray and extraordinary ray. **(4)**

(c) What is Nicol prism and how is it used to produce polarized light? **(8)**