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Total No. of Questions : **9**] [Total No. of Printed Pages : **4**

(2042)

UG (CBCS) IInd Year Annual Examination

2089

B.Sc. PHYSICS

(Waves and Optics)

(DSC ID)/Core

Paper : PHYS 202 TH

Time : 3 Hours] **[Maximum Marks : 50**

Note :– Attempt *five* questions in all. The question paper consists of five Sections. Section A is compulsory. Sections B, C, D and E consist of *two* questions each. Select *one* question from each Section.

Section–A

1. Compulsory question :

   (i) What are the factors on which the natural frequency of an oscillator depend ?

   (ii) What is the difference between positive and negative crystals ?

   (iii) What is relaxation time and how is it related to damping coefficient ?

(iv) What do you mean by induction coupling ?

(v) What is a figure of merit of vibration ?

(vi) Show that $y = x^2 + c^2t^2$ is a solution of one dimensional wave equation.

(vii) What is the difference between normal dispersion and anomalous dispersion ? 2×7=14

Section–B

2. (a) Write the equation of motion of a damped simple harmonic system. What are the solutions of the equation ?

(b) Deduce the frequency and quality factor of a circuit with :

$L = 10\ \mu H$, $C = 5\ \mu F$ and $R = 2\ \Omega$. 5,4

3. (a) Derive the expression for the time period of oscillation of two spring connected in :

(i) Parallel combination

(ii) Series combination

(b) If the displacement equation of SHM be

$$x = A \sin(\omega t + \phi),$$

show that the velocity v and acceleration a satisfy the equation $\omega^2 v^2 + a^2 = A^2\omega^4$. 5,4

Section–C

4. (a) Show that the maximum displacement of a forced damped oscillator by a force $F = F_0 \cos \omega t$ and having damping constant r is given by :

$$A_{max} = \frac{F_0}{\omega' r}, \text{ where } \omega' = \sqrt{\frac{s}{m} - \frac{r^2}{4m^2}}$$

(b) The voltage of 200 V is applied to a series LCR circuit, having $R = 20\ \Omega$, $L = 10\ \mu H$ and $C = 0.01\ \mu F$. Calculate :

(i) Natural frequency

(ii) Q value of circuit at resonance

(iii) Bandwidth of the circuit 5,4

5. (a) Define and explain normal co-ordinates and normal modes of vibration in coupled oscillators.

(b) What is the difference between in phase and out of phase modes ? 5,4

Section–D

6. (a) Discuss how transverse waves are reflected and transmitted at the boundary. Find refraction and transmission coefficients.

(b) Define phase and group velocity. Find the relation between them. 5,4

7. (a) Derive laws of refraction from Huygen's principle.

(b) A soap film 6×10^{-5} cm thick is viewed at an angle of 30° to the normal. Find the wevelengths of the light in the visible spectrum which will be absent from the reflected light (n = 1.33). 5,4

Section–E

8. (a) Distinguish between Fresnel and Fraunhoffer type diffraction. Discuss Fraunhoffer diffraction at a double slit and the position of maxima and minima.

(b) A narrow slit illuminated by light of wavelength 6.4×10^{-5} cm is placed at a distance 3 metres from a straight edge. If the distance between the straight edge and screen is 5 m, calculate the distance between first and fourth dark band. 5,4

9. (a) Describe the construction and working of a Nicol prism. How is it used as a polarizer and analyser ?

(b) What is double refraction ? How will you get circularly and elliptically polarized light ? 5,4