

This question paper contains 4 printed pages.]

Your Roll No.

1243

B.Sc. (Hons.) CHEMISTRY / II Sem. A

Paper – PHCT – 201 – Physics – I

Time : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **four** questions in all including Q. No. **1** which is compulsory.

1. Attempt any **five** questions :

(i) If \vec{A} and \vec{B} are two vectors

$$\vec{A} = i + 2j + 3k, \vec{B} = 3i + j + 2k.$$

Then, find $\vec{A} \times \vec{B}$.

(ii) State and write mathematical forms of Gauss' Divergence Theorem.

(iii) Define centre of mass. Show that in absence of external forces, the velocity of the centre of mass remains constant.

- (iv) In a circuit, a capacitor of $x\mu\text{F}$, an inductor of 0.2H and a resistance of $800\ \Omega$ are joined in series. Find for what value of x the circuit will be oscillatory. [$\omega = 314\ \text{rad/s}$]
- (v) In Young's double slit experiment, a monochromatic light of wavelength $5320\ \text{\AA}$ illuminates two narrow slits separated by a distance of $0.4\ \text{mm}$. Calculate the change in width of fringes when screen is moved from $40\ \text{cm}$ to $100\ \text{cm}$ distant from the slit.
- (vi) How is interference different from diffraction ?
- (vii) Explain Rayleigh's criterion of limit of resolution.
- (viii) Write expression for resolving power of a plane transmission grating. How is it related with dispersive power of grating ?
- (ix) Differentiate between damped and forced vibrations.
- (x) What are Lissajous figures ? What is their importance in Physics ? 5 × 6

2. (a) If \vec{r} is the position vector given by

$$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}, \text{ find } \text{div } \vec{r}.$$

7

(b) Show that $\vec{\nabla} \cdot (\vec{\nabla} \times \vec{A}) = 0$.

8

3. (a) Show that

$$\vec{\nabla} \times (\vec{\nabla} \times \vec{A}) = \vec{\nabla} (\vec{\nabla} \cdot \vec{A}) - \nabla^2 \vec{A} \quad 9$$
- (b) Give physical interpretations of the following :
- (i) Gradient of a scalar quantity
- (ii) Divergence of vector field and
- (iii) Curl of a vector field 6
4. (a) Show that in a head-on collision between two particles, the transfer of energy is the maximum when their mass ratio is unity. 7
- (b) Define the terms torque and angular momentum associated with rotational motion. Also, derive the mathematical relation between them. 8
5. (a) Define moment of inertia and radius of gyration. 5
- (b) Determine an expression for moment of inertia of a solid sphere (i) about an axis through its centre and (ii) about a tangent. 10
6. (a) Explain the term "interference by division of amplitude". Give examples. 3

(b) Describe Young's double slit experiment. Give its relevant theory and determine the conditions for obtaining constructive and destructive interference fringes. Hence, calculate the fringe width of these fringes. 3, 7, 2

7. (a) What is Fresnel's Biprism ? How is it different from an ordinary prism ? 5

(b) Derive an expression for the distribution of intensity due to Fraunhofer Diffraction of a monochromatic light incident normally on a plane transmission grating. Also, draw the intensity pattern. 8, 2
