

[This question paper contains 4 printed pages.]

905

Your Roll No. ....

**B.Sc. (Hons.) / I**

**C**

**CHEMISTRY – Paper V**

**(Physics – I)**

*Time : 3 Hours*

*Maximum Marks : 38*

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

*Question No. 1 is compulsory.*

*Attempt **two** question from*

*Section **A** and Section **B** each.*

1. Attempt any **five** : (2×5)

- (i) Define polar and axial vectors giving examples for each.
- (ii) State Stokes's theorem with all symbols clearly defined.
- (iii) Find a unit vector normal to the surface  $x^2 + 4y^2 + 3z^2 = 5$  at the point (2,1,0).
- (iv) Find  $\vec{\nabla} \times \vec{F}$  where  $\vec{F} = \vec{\nabla} (x^2 + y^2 + z^2 - 3xyz)$ .

P.T.O.

- (v) Show that  $\vec{F} = (2xy + z^3)\hat{i} + x^2\hat{j} + 3xz^2\hat{k}$  is a conservative force.
- (vi) Distinguish between interference and diffraction of Light.
- (vii) State perpendicular axis theorem of moment of inertia.
- (viii) What are central forces ?

### SECTION - A

2. (i) State and prove Work-Energy Theorem. (3)
- (ii) Derive an expression for moment of inertia of a thin spherical shell of radius R and mass M about its diameter. (4)
3. (i) Prove that  $\vec{\nabla} \cdot (\vec{\nabla} \times \vec{A}) = 0$ . (3.5)
- (ii) Find  $\vec{\nabla} \left( \log_e |\vec{r}| \right)$ . (3.5)
4. (i) Establish the equation of forced harmonic oscillator and obtain the steady state solution in case of weak damping approximation. (5)

- (ii) What do you understand by Q-factor of an Oscillator ? (2)
5. (i) What are elastic collisions ? Derive the expression for the final velocities of two bodies of mass  $m_1$  and  $m_2$  after head-on collision.  
[Given that  $u_1$  and  $u_2$  are the initial velocities of  $m_1$  and  $m_2$  respectively]. (3,1)
- (ii) A particle is subjected to two perpendicular SHMs given by  
 $x = 2 \sin \omega t$  and  $y = 4 \sin (\omega t + \phi)$ .  
Find the equation of the resultant path of the particle if  
(a)  $\phi = 0$  and (b)  $\phi = \frac{\pi}{2}$  (3)

### SECTION - B

6. (i) Distinguish between Fresnel and Fraunhofer Diffraction. (2)
- (ii) Derive an expression for intensity in case of Fraunhofer diffraction due to a double slit. (5)
7. (i) What are Newton's rings ? How are they formed ? (1,2)

- (ii) Derive an expression for the radius of the  $m^{\text{th}}$  dark ring formed by reflection. (4)
8. (i) State Brewster's law of polarization. (2)
- (ii) Distinguish between Circularly and Elliptically polarised light. (3)
- (iii) Find the thickness of a quarter wave plate for light of wavelength  $5.9 \times 10^{-7}$  m. Principal refractive indices are  $\mu_o = 1.544$  and  $\mu_e = 1.553$ . (2)
9. Write short notes on any two of the following :
- (i) Zone plate
- (ii) Fresnel's biprism
- (iii) Resolving power of a microscope and telescope
- (iv) Interference due to wedge shaped films (3.5+3.5)