B.A./B.Sc. (General) 6th Semester

(2042)

CHEMISTRY

(Same for B.Sc. Microbial and Food Technology)

Paper—XXIII : Physical Chemistry—B

Time Allowed : Three Hours]   **[Maximum Marks : 22**

Note :— (1)   Attempt *five* questions in all.

(2)   Question No. **I** is compulsory.

(3)   Select *one* question each from (Units II-V).

UNIT—I

I.   (a)   What are crystalline solids ?

(b)   How Miller indices are calculated ?

(c)   How many atoms are there in a body centred cubic unit cell where all atoms are at lattice points ?

(d)   Why H_2 is Raman active but infrared inactive ?

(e)   Which of the molecules will show pure rotational spectra and why : H_2O and NH_4Cl ?

(f)   Explain isotope effect.   1 mark each

UNIT—II

II. (a) Calculate the Miller indices of a crystal planes which cut through the crystal axis at :

    (i) $(2a, -3b, -4c)$

    (ii) $(3/2a, 1/2b, 1c)$

    (iii) $(a, 2b, \infty c)$

    (iv) $(3a, -2b, c)$.

  (b) State law of symmetry in a crystal. Explain by drawing different planes and axis of symmetry for a simple cube.

                  2,2

III. (a) Explain in detail the law of constancy of interfacial angles.

  (b) Distinguish between Miller and Weiss indices.   2,2

UNIT—III

IV. (a) What type of structure is exhibited by NaCl ? Draw and describe its crystal structure in detail.

  (b) Explain photochemical reactions occurring in solid state by giving one example.

                  2,2

V. (a) What are the limitations of Laue's method for crystal analysis ?

  (b) Explain how we can investigate the internal structure of a solid by utilizing Bragg's method.   2,2

UNIT—IV

VI. (a) What are the various factors that affect the width and spectral intensity of spectral lines?

(b) Explain Born-Oppenheimer approximation. When does this approximation break down ?   2,2

VII. (a) Show that the energy difference between the adjacent lines in the rotational spectrum of a rigid diatomic molecule is constant.

(b) How one can determine the bond length in rotational spectral studies of diatomic molecules ?   2,2

UNIT—V

VIII.(a) What is anharmonic oscillator ? What is the reason behind unequally spaced vibrational levels ?

(b) Sketch the diagrams of $\sigma^* \leftarrow \sigma$, $\sigma^* \leftarrow n$ and $\sigma^* \leftarrow \pi$ transitions in the electronic spectra of the molecule.

2,2

IX. (a) Draw and explain the potential energy curves with reference to Franck-Condon principle.

(b) Discuss the theory of Raman spectroscopy and explain how stokes and antistokes lines appear in the spectrum.

2,2