Physical Chemistry - III
(Common with B.Sc. Biotechnology - Part-III) Paper - C
(Re-appear Apri-2013)

Time Allowed : Three Hours   **Maximum Marks : 75**

Note : The candidates are required to attempt at least one question each from Section A, B and C carrying 15 marks each and the entire Section D consisting of 8 short answer type questions carrying 15 marks in all. Attempt five questions in all.

Section - A

1. (a) How the energy is distributed in Black body radiations ?
   (b) Differentiate between Atomic spectra and Molecular spectra.
   (c) What are eigen values and eigen functions ? Give example. 5×3=15

2. (a) Derive Schrodinger wave equation from Postulates of Quantum Mechanics.

   (b) Evaluate $\left[x.\dfrac{d}{dx} \right]$.

   (c) Normalize the function $y = A \sin \left(\dfrac{n\pi}{a}.x \right)$ between 0 and a.   5×3=15

3. (a) What is Quantum Mechanical principle of Hybridisation ?
   (b) Calculate coefficients of atomic orbitals for Sp-hybridisation.
   (c) Differentiate between VBT and MOT.   5×3=15

Section - B

4. (a) Derive and expression for vibrational rotational spectra. What are P, Q, R lines ?
   (b) Calculate the force const K for N_2 molecule given that the fundamental vibrational frequency is $7.0×10^{13}$ s^{-1}.   7½×2=15

5. (a) What do you mean by Isotopic effect ? How it affects the spectral lines in case of rotational spectra.
   (b) Draw vibrational degrees of freedom for CO_2 molecules.
   (c) What are term symbols ? Find the term symbol for H_2^+.   5×3=15

6. (a) Discuss Raman Spectra in detail.
   (b) Explain Franck-Condon principle.   7½×2=15

Section - C

7. (a) Draw Jablonski diagram. Depict the radiative, non-radiative, internal conversion, intersystem crossing, fluorescence and phosphorescence.   10
   (b) What are photosensitizers and photoinhibitors ? Give examples.   5

8. Discuss the following :
   (a) Laws of symmetry   (b) Powder method
   (c) Miller indices.   5×3=15

Section - D (Compulsory Question)

9. Answer the following in brief :
   (a) Define Unit Cell.
   (b) What are operators ? Illustrate with example.
   (c) What are normalized wave functions ?

   (d) Evaluate $\left(x + \dfrac{d}{dx} \right)^2$.

   (e) Which type of molecules show IR spectra and why ?
   (f) Write expression for Hamiltonian operator.
   (g) Find the Miller's indices for the intercept (3a, b, 2c).
   (h) What is zero point energy ?   (7×2)+(1×1)=15