This question paper contains **3** printed pages]

AY—283—2018
FACULTY OF SCIENCE
M.Sc. (Second Semester) EXAMINATION
MARCH/APRIL, 2018
(CBCS Pattern)
CHEMISTRY

[CH-424]

[Principles of Spectroscopy]

(Wednesday, 18-4-2018)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours   *Maximum Marks—75*

N.B. :— (*i*) Attempt *All* questions.

(*ii*) Use of calculator or logarithmic table is allowed.

(*iii*) Constant :

$c = 3 \times 10^8$m/s

$h = 6.626 \times 10^{-34}$ Js.

1. Attempt any *three* of the following :   15

   (*a*) Explain reflection and refraction of light radiation.

   (*b*) What condition is required for the molecules to show mivrowave spectra ? Explain the relative intensities of rotational spectral lines.

   (*c*) The force constant fo H-F molecule is 970 Nm^{-1}. If the reduced mass is 1.59×10^{-27} kg, then determine the fundamental vibrational frequency.

   (*d*) How will you obtain photoelectron spectrum ?

   (*e*) Enumerate the basic principle involved in NMR spertroscopy. Explain nuclear resonance.

2. Attempt any *three* of the following :   15

   (*a*) Explain uncertainty relation and natural line width.

   (*b*) The pure rotational spectrum of diatomic molecule consists of series of equally spaced lines separated by $320m^{-1}$. Calculate the internuclear distance if the reduced mass of this molecule is 1.67×10^{-27} kg.

P.T.O.

(c) What is zero point energy ? Explain first overtone, second overtone and hot band in vibrational spectrum.

(d) Give an account of vector representation of momenta.

(e) Explain the factors affecting the 'g' value.

3. (a) Explain quantum theory of Raman effect. Give the difference between I.R. and Raman spectra. 8

Or

Explain the spectra of diatomic molecule as a simple harmonic oscillator. Give an account of metal-ligand vibrations. 8

(b) Explain electric field gradient and quadrupole moments. Give applications of NQRS. 7

Or

Describe vibronic transitions and geometry of the exited states. Give brief idea of internal conversion. 7

4. Answer the following : 8

(a) (i) Explain shielding and deshilding.

(ii) Give an account of ABC splitting.

Or

(i) What do you mean by isotropic and anisotropic hyperfine coupling constants.

(ii) Give the applications of E.S.R. spectroscopy. 8

(b) Enumerate the principle involved in FT NMR. Give the use of NMR in medical diagnostics. 7

Or

(i) Explain Resonance Raman spectrum.

(ii) Give the factors affectinng the band position and intensities. 7

5. (A) Select the correct alternative for the following multiple choice questions : 5

   (i) The intensity of rotational spectral lines is determined by :

   (a) Degeneracy of ratational level

   (b) Influence of nulear spin on population

   (c) Both (a) and (b)

   (d) None of the above

   (ii) As bond length decreases, force constant :

   (a) Increases (b) Decreases

   (c) Remains unaffected (d) Becomes zero

   (iii) C^{13} n,m,r, spectra was first studied in 1957 by :

   (a) P-C. Lauterbur (b) Hansen

   (c) Packard (d) Purcell

   (iv) NQR spectra is observed in :

   (a) I-R (b) U-V

   (c) Visible (d) Radio wave

   (v) The removal of degeneracy of spin states by the internal magnetic field of paramagnetic electron is termed as :

   (a) Fine splitting (b) Zero-field splitting

   (c) Both (a) and (b) (d) Hyperfine spliting

   (B) Write notes on any *two* of the following : 10

   (a) Applications of microwave spectroscopy.

   (b) Photoelectric effect.

   (c) Radiative and Non-Radiative transitions.