Code No. 8509 / AB

FACULTY OF SCIENCE

M. Sc. I – Semester Examination, December 2013

Subject: Chemistry

Paper – IV : Mathematics and Spectroscopy
(To be answered by the students without Maths in B.Sc.)

Time: 3 Hours **Max. Marks: 80**

Note : Write all answer in one answer sheet only. Answer all questions.

PART – A (4 x 8 = 32 Marks)
(Short Answer Type)

1.(a) Draw the graphs of the following standard functions.
(i) y = ln x (ii) $y=e^x$ (iii) $y = 2x^2$ (iv) y = cos x.

(b) If $y = \sqrt{5x+2}$, Find $\frac{dy}{dx}$.

2.(a) What are the factors affecting the spin spin coupling constant values?
(b) How is the NMR spectroscopy useful in the study of fluxional molecules?

3.(a) Explain stoke lines and anti stoke lines in rotational spectroscopy.
(b) Write a brief note on vibration-rotation spectra of diatomic molecules.

4.(a) How can you distinguish cis and trans isomers by electronic spectroscopy?
(b) Explain bathochromic shift and hypsochromic shift.

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

5.(a) $[H^+]x[OH^-] = 1.0 \times 10^{-14}$. At what concentration of Hyderogen ions will the sum of the hydrogen ions and hydroxyl ions (y) be a minimum?

(b) If $y = (x^3 -1)^4$, find $\frac{dy}{dx}$

OR

(c) Evaluate the integral $\int x.\cos 2x.dx$

(d) If $2(x.\frac{dy}{dx}+3y) = xy.\frac{dy}{dx}$. Show that $x^6y^2=C.e^y$.

6.(a) Explain the NMR spectra of (i) Ethyl benzene (ii) Benzoic acid.
(b) Define spin-spin coupling and explain vicinal, geminal and long range couplings.

OR

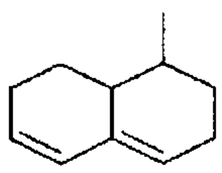
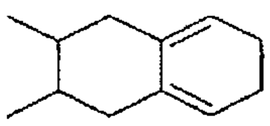
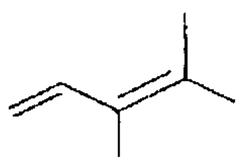
(c) Discuss the applications of NMR spectroscopy with reference to
(i) Hydrogen bonding (ii) Proton exchange process
(d) Explain the NMR spectrum of $[H\ Ni(OPEt_3)_4]$, $[H\ Rh\ (CN)_5]^{3-}$

7.(a) The force constant of H^1Cl^{35} is 483 Nm^{-1}. Calculate the fundamental vibrational frequency of HCl(in cm^{-1}).
(b) Explain (i) fundamental bands (ii) overtone bands and (iii) Fermi resonance

OR

(c) Write a note on different stretching and bending modes of molecules.
(d) Discuss the classification of molecules based on moment of inertia and principle of microwave spectroscopy.

8.(a) Calculate the λ_{max} for the following molecules.

(i)  (ii)  (iii) 

(b) How the Beer's Law is useful to calculate the dissociation constant of weak acid? Explain.

OR

(c) Discuss the electronic spectroscopy of $3d^3$ hexa aquo complex and analyze it.
(d) Explain different types of electronic transitions.

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