BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSc **SEMESTER : IX**
BRANCH: CHEMISTRY **SESSION : MO/19**

SUBJECT: SAC2007 APPLICATION OF SPECTROSCOPY

TIME: 3:00 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) With suitable diagram compare the Morse Potential diagrams for Harmonic oscillator and anharmonic oscillator showing the vibrational energy levels. [6]

Q.1(b) Analyse the IR and Raman activity for the normal mode of vibrations of H_2O. [6]

Q.2(a) Draw the esr spectrum for vanadyl ion (VO^{+2}) showing the transitions ($I_V{}^{+4} = 7/2$). [6]

Q.2(b) Discuss the epr spectrum of MnF_2. [6]

Q.3(a) Discuss the relaxation processes in ESR transitions [6]

Q.3(b) Compare the esr spectrum of $\cdot CH_2OH$ and $\cdot CH_2(OCH_3)$ radicals. [6]

Q.4(a) Explain the concept of Circular Dicroism (CD). Explain with the help of clear schematics. [3+3]
What is cotton effect? With clear schematics, explain positive and negative cotton effect. 3 marks

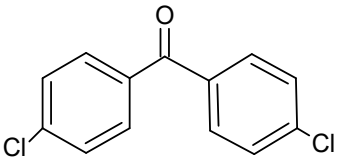
Q.4(b) Explain how Circular Dicroism (CD) of protein can be used to determine the structure of an unknown random coil of protein. [6]

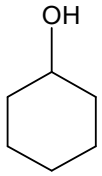
Q.5(a) Illustrate *Stevenson's rule* of fragmentation in Mass Spectroscopy, taking the example of 3-ethyl-3-methylhexane [6]

Q.5(b) What do you mean by 'isotope effect' in mass spectroscopy? Illustrate isotope effect in the following compounds (i) $CHBr_3$,ii) CH_2Cl_2 [6]

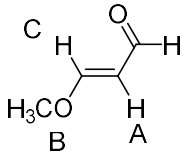
Q.6(a) Predict the 'base peak' in mass spectroscopy of the following compounds. Give reason. (i) n- hexane (ii) 2-methyl pentane (iii) Butanone [6]

Q.6(b) Outline the molecular fragmentation pattern in the MS of the following compounds: [6]





Q.7(a) i) Deduce a fundamental Equation of NMR to demonstrate the relation between applied magnetic field and radiofrequency. [3+3]
ii) Discuss the approximate 1H NMR chemical shift, splitting pattern with coupling constant for the protons A-D in the following compounds are:



Q.7(b) i) Why TMS is preferred choice to use as reference for NMR Samples. ii) An organic compound having molecular formula $C_6H_{11}BrO_2$ exhibits the following peaks in 1H NMR: δ: 4.1 (2H, q, J = 7.5 Hz); 4.0 (2H, t, J = 7.5 Hz), 1.5-2.2 (2H, m,); 1.25 (3H, t, J = 7.5 Hz), Determine the structure. [2+4]

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