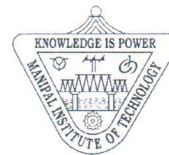Reg. No.

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

I SEMESTER M.Sc., CHEMISTRY END SEMESTER
EXAMINATIONS, DEC/JAN 2015

SUBJECT: ORGANIC SPECTROSCOPY [CHM 607]
REVISED CREDIT SYSTEM

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

❖ Answer **ANY FIVE full** questions.
❖ Missing data may be suitable assumed.
❖ Draw diagrams and write equations whenever necessary

1A. How do you distinguish inter and intra molecular hydrogen bonding using FTIR spectrum? Explain with suitable examples.

1B. Give reasons for the following:

    i) Symmetric stretching vibration of H_2O is IR active.

    ii) Spherical top molecules are microwave inactive.

    iii) n-π^* transitions shift to shorter wavelengths in UV in presence of polar solvents.

    iv) Intensities of Stoke lines are greater than that of anti-stoke lines in Raman spectroscopy.

1C. What is electromagnetic radiation? Discuss the effect of interaction of EMR in different regions of electromagnetic spectrum.

(2+ 4+ 4)

2A. With a schematic diagram explain the working of internal standard photometer.

2B. Define Symmetry operation & Symmetry element. Explain the following symmetry elements with any two examples in each case.

2C. Deduce Hook's law and calculate the approximate wave number of the fundamental absorption peak due to the stretching vibrations of a carbonyl group. The force constant for a double bond has an approximate value of 1×10^6 dynes/cm. The masses of carbon and oxygen atoms are 1×10^{-23} and 2.6×10^{-23} g per atom.

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3A. Define the terms auxochromes and chromophores. Discuss their importance in UV spectroscopy

3B. State and deduce Beer's law. Calculate the absorbance and molar absorptivity of 7.25×10^{-5} M solution of $KMnO_4$, which has a transmittance of 44.1 % when measured in a 2.10 cm cell at a wavelength of 525 nm.

3C. i) What is transformation matrices? Give the matrix representation for all the symmetry operations in any one point group.

ii) What is character table? Explain with a suitable example.

(2+ 4+ 4)

4A. The inter nuclear distance of the carbon monoxide molecule is 113 pm. Calculate the energy of this molecule in the first excited rotational level. The atomic masses are $^{12}C = 1.99 \times 10^{-26}$ kg and ^{16}O = 2.66×10^{-26} kg.

4B. What is Morse function? Derive mathematical expression for fundamental, first overtone and second overtone frequencies using an anharmonic oscillator model.

4C. Discuss the applications of molecular symmetry with suitable examples

(2+ 4+ 4)

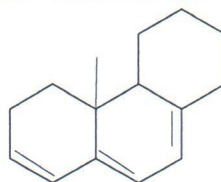**5A.** What is plasma? Explain the construction and working of ICP torch.

5B. What is meant by the background interference in the atomic absorption spectrum? Discuss the different types of background interferences.

5C. Describe Woodward Fieser rules for diene? Calculate the λ_{max} for the following compounds.

i)

ii)

(2+ 4+ 4)

6A. Differentiate between the following:

  i)   Atomic and molecular spectroscopy

  ii) Single beam and double beam spectrophotometer

6B. Write four characteristics of Raman lines. The rotational Raman spectrum of H_2 gas is found to consist of a series of Stokes and antistokes lines the first of which appears at 345.9 cm-1 relative to the source of excitation. Calculate the bond distance of H_2.

6C. Describe the instrumentation involved in microwave technique.

(2+ 4+ 4)

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