MANIPAL UNIVERSITY

Reg No										

DEPARTMENT OF SCIENCES

I SEMESTER M.Sc (CHEMISTRY) END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: ORGANIC SPECTROSCOPY [CHM 607]

REVISED CREDIT SYSTEM

Time: 3 Hours Date: 30/11/2016 MAX. MARKS: 50

Instructions to Candidates:

Answer **ANY FIVE FULL** questions.

Write chemical equations wherever necessary.

1A. Discuss the moment of inertia equations involved in spherical top and asymmetric top molecules in Microwave Spectroscopy. Comment on their microwave activity.

1B. Distinguish symmetry element from symmetry operation. Describe all the symmetry operations that can be carried on BF_3 and NH_3 molecules.

1C. Describe the basic principles of FTIR instrument. Write any four advantages of FTIR instrument over the dispersive instruments.

2+4+4

2A. Give reason for the following:
i) The lifetime of a tungsten-halogen lamp is more than double that of an ordinary tungsten lamp.
ii) Stokes lines are more intense than anti-stokes lines in Raman spectrum.

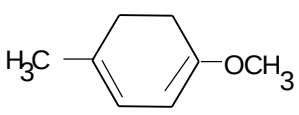
2B. **i)** Differentiate between the following;
a) IR and Raman Spectroscopy
b) Rigid and non-rigid Microwave Spectra of a diatomic molecule
ii) Pure rotational (microwave) spectrum of the gaseous molecule CO consist of a series of equally spaced lines separated by 3.7978 cm^{-1}. Calculate the inter nuclear distance and the first excited rotational level energy of the molecule. The molar masses are ^{12}C = 1.99 x 10^{-26} kg and ^{16}O = 2.66 x 10^{-26} kg.

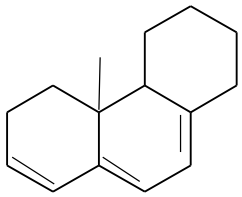
2C. State and deduce Beer-Lambert's law. Discuss the instrumental deviations from Beer's law.

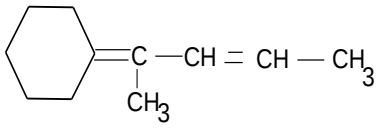
2+4+4

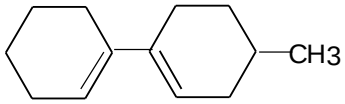
3A. Discuss the various types of electronic transitions involved in organic molecules in UV Spectroscopy with suitable examples.

3B. Compute the λ_{max} for the following compounds based on the Woodward Fieser rules for diene.

i) 

ii) 

iii) 

iv) 

3C. **i)** Calculate the Raman shift in cm^{-1} and the wavelength in which anti-Stokes line will appear in the Raman spectrum if a sample was excited by the 430 nm line of mercury and a Raman line was observed at 460 nm.

ii) Give reasons for the following;

a) Inter and intra hydrogen bonding can be distinguished by IR spectral data.

b) Photo cell is a better detector in UV region compare to photo voltaic cell

2+4+4

4A. Describe the various energy levels possessed by organic molecules and write the interaction of Microwave and IR regions of the electromagnetic spectrum with these molecules.

4B. Identify the point group of water molecule and prove that the set of symmetry operations of this molecule forms an Abelian group.

4C. Explain the procedure for the quantitative determination of calcium present in a sample of water through Atomic Absorption Spectroscopy.

2+4+4

5A. 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^{-26} and 2.6×10^{-26} kg per atom, respectively.

5B. Write a note on Nebulization of the liquid sample carried out in Atomic Absorption Spectroscopy. Describe the functions of hollow cathode lamp, chopper and monochromator.

5C. **i)** What is a point group? Mention the special point groups and dihedral point groups.

ii) Identify the point groups for the following molecules.

a) CCl_3F **b)** Ethylene **c)** $Ni(CO)_4$

2+4+4

6A. Write the advantages of Atomic Absorption Spectroscopy over Flame Photometry. Mention two applications of Atomic Absorption Spectroscopy.

6B Discuss in detail the flame and non-flame atomizers used for atomizing the liquid sample in Atomic Absorption Spectroscopy.

6C. Explain the factors responsible for the width and intensity of spectral lines.

2+4+4

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