MANIPAL
ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

Reg. No.										

DEPARTMENT OF SCIENCES, I SEMESTER M.Sc (CHEMISTRY)
END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: SPECTROSCOPY-I [CHM – 4107]
(REVISED CREDIT SYSTEM-2017)

Time: 3 Hours Date: 27th Nov 2018 MAX. MARKS: 50

Note: (i) Answer **ALL** questions
(ii) Draw diagrams, and write equations wherever necessary

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

1B. State and deduce Beer's law. Calculate the transmittance and molar absorptivity of $KMnO_4$ solution of 7.25×10^{-5} M concentration, having an absorbance of 0.355, when measured in a 2.10 cm cell at a wavelength of 525 nm.

1C. How do you distinguish between the following by using IR spectroscopy?
i) Primary and secondary amines
ii) Cis and trans geometric isomers
iii) Stretching and bending vibrations
iv) Inter and intramolecular hydrogen bonding

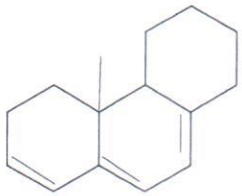
2+4+4

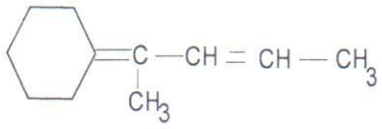
2A. Account for the following:
i) Cyclohexane is UV inactive whereas benzene is UV active
ii) The n-π* transition moves to shorter wavelength by increasing the polarity of the solvent.

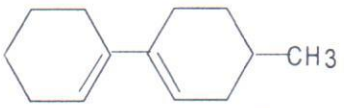
2B.i) Describe Quantum theory of Raman Spectroscopy and write any four characteristics of Raman lines
ii) The pure rotational (microwave) spectrum of gaseous HCl consists of a series of equally spaced lines separated by 20.80 cm^{-1}. Calculate the internuclear distance of the molecule. The atomic masses are $^1H = 1.673 \times 10^{-27}$ kg, $^{35}Cl = 58.06 \times 10^{-27}$ kg.

2C. Compute the λ_{max} for the following compounds based on the Woodward-Fieser rules for diene.

i) 

ii) 

iii) 

iv) 

2+4+4

3A. 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.

3B. Give reasons for the following;

i) The lifetime of a tungsten-halogen lamp is more than double that of an ordinary tungsten lamp.

ii) All three vibrational modes of H_2O are IR active.

iii) Broad peaks are observed in UV-Visible spectrum.

iv) Accuracy and resolution is more in FTIR instrument than that of dispersive instruments.

3C. 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.

2+4+4

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

4B. Explain the procedure for the quantitative determination of cadmium present in a sample of water through Atomic Absorption Spectroscopy. Explain the spectral and ionization interference observed in this technique.

4C. Distinguish the symmetry element from a symmetry operation. Mention all the symmetry operations that can be carried on BF_3, benzene and NH_3 molecules.

2+4+4

5A. Explain with example the identification of molecules possessing permanent dipole moment based on the symmetry aspects of a molecule.

5B. Explain the factors responsible for the width and intensity of spectral lines

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) PCl_3 b) Planar trans H_2O_2

2+4+4

****