MANIPAL UNIVERSITY

Reg. No.

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DEPARTMENT OF SCIENCES, I SEMESTER M.Sc (CHEMISTRY)
END SEMESTER EXAMINATIONS, Nov/Dec 2017
SPECTROSCOPY-I [CHM 4107]

(REVISED CREDIT SYSTEM-2017)

Time: 3 Hours Date: 23.11.2017 MAX. MARKS: 50

Note: (i) Answer all **FIVE FULL** questions

(ii) Draw diagrams, and write equations wherever necessary

1A. What are the advantages in Atomic Absorption Spectroscopy of a heated graphite atomizer over a flame atomizer? Explain the background correction carried out in this spectroscopic technique.

1B. Identify the principal rotation axis and the reflection mirror planes of the following molecules based on the symmetry aspects of a molecule.
a) BF_3 b) $PtCl_4^{2-}$ c) Benzene d) Eclipsed ethane

1C. Describe how the following factors contribute to the width and intensity of spectral lines
i) Collision broadening
ii) Heisenberg uncertainty principle
iii) Transition probability
iv) Path length of sample

2+4+4

2A. Explain in brief the prism and grating momochromators.

2B. What is the reason for observing spectral lines of different intensities in the microwave spectrum of molecule? Calculate the J_{max} for a rigid diatomic molecule for which rotational constant is 1.566 cm^{-1} at 300K.

2C. What are the IR absorption ranges of carbonyl and amine group? How do you differentiate between the primary, secondary and tertiary amines using IR spectra?

2+4+4

3A. Distinguish the following
i) C_{nh} and D_{nd} point groups
ii) Symmetry element and symmetry operation

3B. Draw a schematic diagram of the instrumentation involved in Atomic Absorption Spectroscopy and explain the function of each of the parts.

3C. Determine the point groups of the given molecules by following the systematic procedure.
a) Planar cis H_2O_2 b) Naphthalene c) $SiCl_4$ d) HCl

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4A. Explain redshift and blue shift in UV spectroscopy.

4B. What is the need for FTIR? Compare FTIR with dispersive IR spectroscopy

4C. What are chromophors and auxochromes? Calculate the concentration of a αβ-unsaturated ketone of relative molecular mass 110 which has an absorption band with λ_{max} at 215 nm and ε 1000.

2+4+4

5A. Explain the following interferences with example in Atomic Absorption Spectroscopy.

i) Spectral Interference

ii) Solvent Interference

5B. Define inversion center in a molecule and show that $C_2\sigma_h = i$ for trans dichloroethylene, Prove that an odd order S_n axis generates 2n operations by taking eclipsed ethane as an example.

5C. Explain the principle of Raman spectroscopy. Give the selection rule for vibrational – rotational Raman spectra of a diatomic molecule and explain the Q, S and R branches of the spectrum.

2+4+4

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