

Reg. No.					

Deemed- to -be -University under Section 3 of the UGC Act, 1956

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

## (REVISED CREDIT SYSTEM-2017)

Time: 3	Hours	Date: 26.12.2017		MAX. MARKS: 50				
Note:	(i) Answer all <b>FIVE FU</b>	JLL questions						
(	(ii) Draw diagrams, and write equations wherever necessary							
1A. Based on the symmetry aspects explain why $H_2O$ is a dipole while $CH_4$ is a non-dipole. 1B. Identify the point groups of the molecules given below by following a systematic procedure								
a) C	Cl <sub>4</sub> b) cis-di	chloroethylene	c) CO <sub>2</sub>	d) NO <sub>3</sub> <sup>-</sup>				
1C. What is Doppler Effect? Explain the factors responsible for the width of spectral lines.								
				2+4+4				

- 2A. Explain the Stokes and anti-Stokes Raman spectra for linear molecules by applying appropriate selection rules. Why is Stokes line usually more intense?
- 2B. Explain the classification of molecules into groups based on the relative values of their three principal moment of inertia depending on their shape.
- 2C. Derive the mathematical expression for IR absorption frequency of a vibrating diatomic polar molecule. Give the expression for vibrational energy considering the same as simple harmonic oscillator.
- 3A. Identify the rotation-reflection operation  $(S_n)$  which can be carried on trans dichloroethylene and eclipsed ferrocene.
- 3B. Identify the point group of m-dichlorobenzene and prove that the set of symmetry operations of this molecule forms an Abelian group.
- 3C. Explain the procedure for the quantitative determination of cadmium present in a sample of water through Atomic Absorption Spectroscopy. Write the advantages of Atomic Absorption Spectroscopy over Flame Photometry.
   2+4+4
- 4A. Mercury lamp radiation of wavelength 4358 angstrom was used to study the Raman spectra of a sample and the observed Raman shift was 460cm<sup>-1</sup>. At which wavelength in angstrom units would the anti-Stokes line appear for this sample?
- 4B. What are the requirements of the IR source of radiation? Discuss the four types of IR radiation sources.
- 4C. Calculate the frequency, wavenumber and energy for a typical ultraviolet radiation of wavelength of 250 nm. Discuss the differences in the IR spectra of
  i) 1-octyne and 4-octyneii) butanal and butanone.

2+4+4

5A.Calculate the  $\lambda_{max}$  for the following molecules based on the Woodward Fieser rules.

(i)



(ii)



- 5B. Which of the following compounds absorb UV radiation? Justify your answer with proper explanation. a) Water, b) Phenol, c) Ethanol, d) Ethylene, e) Aniline, f) Benzoic acid. Among 1, 4-pentadiene, *cis*-1,3-pentadiene and *trans*-1,3-pentadiene, which isomer has higher  $\lambda_{max}$ ? Give reason.
- 5C. 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

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