

6 SEM TDC CHM M 7 (N/O)

2018

(May)

CHEMISTRY

(Major)

Course : 607

(Spectroscopy)

*The figures in the margin indicate full marks
for the questions*

(New Course)

Full Marks : 48

Pass Marks : 14

Time : 2 hours

1. Choose the correct answer :

1×5=5

**(a) Radio frequency radiations are useful in
causing transition for**

(i) mass spectrum

(ii) NMR spectrum

(iii) Raman spectrum

(iv) None of the above

- (b) An auxochrome is one which is
- colour enhancing
 - a group or an atom with lone pairs of electrons
 - extending conjugation
 - All of the above
- (c) The IR band spectra show the changes in vibrational and rotational energies of a molecule subject to selection rule
- $\Delta v = 0, \Delta j = \pm 1$
 - $\Delta v = \pm 1, \Delta j = \pm 1$
 - $\Delta v = \pm 1, \Delta j = \pm 2$
 - $\Delta v = 0, \Delta j = 0$
- (d) Raman effect is
- absorption of light
 - emission of light
 - inelastic scattering of light
 - elastic scattering of light
- (e) The multiplicity of signals in $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$ in NMR spectrum is
- two triplets
 - one triplet and one quartet
 - two singlets
 - two singlets and two triplets

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2. Answer any *five* of the following : $2 \times 5 = 10$

- Compared to the number of bonds in a molecule, there are generally more number of peaks in the infrared spectrum. Explain.
- The nuclei ^1H and ^{13}C are suitable for NMR investigation. Explain why.
- Describe briefly 'fingerprint region' of infrared spectroscopy.
- Stokes lines are more intense than anti-Stokes lines. Explain.
- Microwave studies are done only in gaseous state. Why?
- Aniline absorbs at 280 nm, but in acidic medium this absorption band is seen at 203 nm. Explain giving proper reason.

UNIT—I

3. (a) Show that the lines in the rotational spectrum of a diatomic molecule are equispaced under rigid rotator approximation. $2\frac{1}{2}$
- (b) Find the value of rotational quantum number j in the most highly populated rotational level of CH_4 ($B = 5.24 \text{ cm}^{-1}$) at room temperature. $2\frac{1}{2}$

UNIT—II

4. (a) Explain the effect of anharmonicity on the vibrational spectra of diatomic molecules.

Or

Sketch the normal modes of vibration of a non-linear triatomic molecule AB_2 and predict the IR active bands. Give reason in support of your answer.

- (b) Explain what will happen when a molecule is irradiated with infrared radiations.
- (c) The C—H stretching vibration in chloroform occurs at 3000 cm^{-1} . Calculate the C—D stretching frequency in deuteriochloroform.

UNIT—III

5. (a) Explain the application of Raman spectroscopy in determining the structure of a molecule with specific examples.

- (b) A sample was excited by the 4358 Å line of mercury. A Raman line was observed at 4447 Å . Calculate the Raman shift in cm^{-1} .

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(Continued

Or

Discuss the quantum mechanical explanation of Raman effect.

- (c) Write the condition for the molecule to be Raman active.

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UNIT—IV

6. (a) State and explain Franck-Condon principle.

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- (b) Explain the effects of change of solvents on $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ transitions.

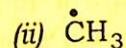
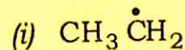
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- (c) What do you mean by a good solvent in UV spectroscopy?

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UNIT—V

7. (a) Write two applications of ESR spectroscopy. Predict the number of lines in the ESR spectra of the following systems :

 $1+1+1=3$ 

Or

Discuss briefly the principle of ESR spectroscopy.

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(Turn Over)

- (b) Discuss the relaxation processes in NMR spectroscopy.

Or

Describe Larmor precession and precessional frequency.

- (c) Define coupling constant.