



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**B.Sc. DEGREE EXAMINATION – CHEMISTRY**

**FIFTH SEMESTER – APRIL 2016**

**CH 5513/CH 5508 – FUNDAMENTALS OF SPECTROSCOPY**

Date: 06-05-2016

Dept. No.

Max. : 100 Marks

Time: 09:00-12:00

**PART-A**

Answer ALL questions

(10x2=20marks)

1. Define rigid rotor.
2. Which of the following molecules are micro wave active?  
 $\text{Br}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{HBr}$ ,  $\text{CO}_2$
3. State Beer-Lambert's law.
4. What are chromophores? Give an example.
5. What are fundamental and overtone vibrations?
6. State mutual exclusion principle.
7. Define chemical shift.
8. Which of the following are NMR active? Give reason.  
 ${}^6\text{C}^{12}$ ,  ${}^9\text{F}^{19}$ ,  ${}^1\text{H}^2$ ,  ${}^7\text{H}^{14}$ .
9. Differentiate between Stokes lines and Antistokes lines.
10. State Nitrogen rule.

**PART-B**

Answer any **EIGHT** questions

(8x5=40marks)

11. Explain the various regions of electromagnetic spectrum.
12. Give the factors influencing the intensity of spectral lines.
13. Explain in detail the types of electronic transitions possible in a molecule.
14. (a) The UV absorption peaks are usually broader than the IR absorption peaks. Explain.  
(b) Give the difference between singlet and triplet excited states. (3+2)
15. Give the block diagram for IR spectroscopy.
16. Discuss the classical theory of Raman spectroscopy.
17. Bring out the differences between IR and Raman spectroscopy.
18. The following compounds show only one NMR peak. Write suitable structural formula for the same.  
(a)  $\text{C}_3\text{H}_6$  (b)  $\text{C}_2\text{H}_4\text{Br}_2$ . (2.5 + 2.5)

19. Name the standard used in NMR and give reasons for using it as the standard.
20. Explain NMR saturation and relaxation.
21. What are the major components of a mass spectrometer?
22. Explain isotope peaks and their applications.

**PART-C**

Answer any **FOUR** questions

(4x10=40 marks)

23. Explain the principle, instrumentation and applications of Flame Photometry.
  24. (a) Explain the experimental factors affecting  $\lambda_{\max}$  (5)  
(b) Give the important parts of a UV-spectrophotometer. (5)
  25. Draw the fundamental vibrational modes of  $\text{CO}_2$  and  $\text{H}_2\text{O}$  molecule,  
Which among them are IR and Raman active?
  26. (a) How will you distinguish between salicylic acid and p-hydroxy benzoic acid by IR spectroscopy? (6)  
(b) Give the vibrational frequencies for the following functional groups.  
(i)  $\text{C}=\text{O}$  (carboxylic acid) (ii)  $-\text{OH}$  (iii)  $-\text{NH}_2$  (iv)  $\text{C}=\text{O}$  (aldehyde). (4)
  27. (a) Give an account of shielding and deshielding of protons in NMR spectroscopy. (7)  
(b) A compound gives a proton NMR peak at 250 Hz downfield from the TMS peak in a Spectrophotometer operating at 50 MHz. Calculate the value of chemical shift. (3)
  28. (a) How will you distinguish the three isomeric butanols on the basis of mass Spectrometry.  
(i) 1-Butanol (ii) 2-Butanol. (6)  
(b) A compound with molar mass 16 shows its M and M+1 peaks with an intensity ratio 100: 1.1. Find the molecular formula of the compound. (4)
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