2025
M.Sc.
4th Semester Examination
CHEMISTRY
PAPER – CEM-401
Full Marks: 50 Time: 2 Hours
(CEM 401-Advanced Spectroscopy-II)

Group A

Answer any ***four*** bits: **2×4 = 8**

1. What do you mean by Coupling constant?
2. What is Chemical shift?
3. Show the fragmentation pattern of cyclopentanol.
4. Write down the main principle of CD spectroscopy?
5. Give the typical fragmentation pattern in benzyl methyl ether.
6. Why is vacuum needed in mass spectrometry?

Group B

Answer any ***four*** bits: **4×4 = 16**

7. (i) What is meant by precessional frequency of a nuclear magnet? (ii) Why is it necessary for a nucleus to behave as a tiny magnet to be studied by NMR spectroscopy? (2+2)
8. (i) Write a short note on McLafferty rearrangement. (ii) Why is TMS chosen as the reference compound in 1H NMR spectroscopy? (2+2)
9. How will you distinguish three isomeric butanols on the basis of mass spectrometry? 4
10. Suggest a probable structure of a compound having molecular formula $C_8H_{12}O_4$ from its following ^1H NMR spectral data. (i) δ 1.30 (6H, t, J=7Hz), (ii) δ 4.25 (4H, q, J=7Hz), (iii) δ 6.80 (2H, s). 4
11. (i) How is CD spectra helpful to understand drug-DNA interaction? (ii) What is the main difference between CD and UV spectroscopy? (2+2)
12. What is diamagnetic anisotropic effect? Describe it with suitable example. 4

Group C

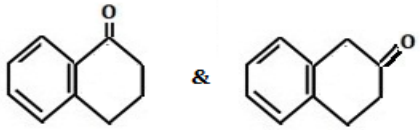
Answer any two bits: **8×2=16**

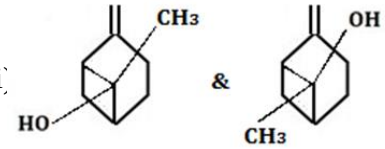
13. (i) Predict the structure of the organic compound which exhibits m/e peaks at 86, 71, 58, 43 (100%) in mass spectrum.
(ii) Describe the importance of metastable peaks. (4+4)

14. (i) How can you distinguish between 1-propanol and 2-propanol by mass spectrometry?
(ii) An organic compound with molecular weight 108 is not acidic in nature but can be easily oxidized to a crystalline compound (melting point 122°C). It gives the following spectral data:
UV: λ_{max} 255 mμ, ε_{max} 202
IR: 3402 (s, b) 3065 (w), 2288 (m), 1499 (w), and 1455 cm^{-1} (m)
NMR: 2.74τ (singlet, 24.5 squares), 5.4τ (singlet, 9.5 squares), and 6.10τ (singlet, 4.8 squares). (3+5)

15. (i) Compound having molecular formula C_8H_6 shows two ^1H NMR signals at δ 3.08 (s) and δ 7.4 (m) in the ratio of 1:5. Suggest a structure for the compound.
(ii) Predict the probable structure of the compound (MF: $C_{12}H_{18}$) which shows only one ^1H NMR signal at δ 2.2 (s). (5+3)

16. How will you differentiate the following pairs by NMR spectroscopy?

(i) 

(ii) 

(iii) *Cis*-stilbene and *trans*-stilbene. (3+3+2)

Internal Assessment-10

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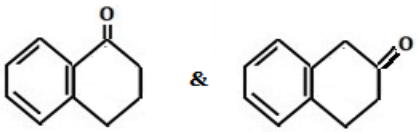
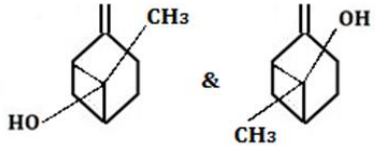
(i)  &

(ii) 

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