D2ACH2004	(2 Pages)	Name:
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SECOND SEMESTER M.Sc. DEGREE EXAMINATION APRIL 2021 CHEMISTRY

FCHE2C08- MOLECULAR SPECTROSCOPY

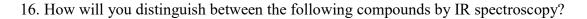
Time: 3 hrs Maximum Weightage: 30

Section A: Short answer questions. *All* questions can be answered. Each carries *one* weightage (Ceiling 6 weightage).

- 1. What is meant by rigid rotor? State the selection rule for the rotational transitions of a rigid rotor.
- 2. State and explain mutual exclusion principle.
- 3. How will you distinguish between the overtones and hot bands of a spectrum?
- 4. How many vibrational modes of CO₂ are infrared-active? How many peaks will they totally yield in an IR spectrum of CO₂?
- 5. Write Karplus relationship and explain the terms in it.
- 6. What are the factors which affect the chemical shift?
- 7. Explain the term Kramer's degeneracy.
- 8. What do you understand by nitrogen rule?
- 9. Mention the type of absorption and intensity shifts in UV spectroscopy.
- 10. Why TMS is used as internal standard in NMR studies?
- 11. Benzene is colorless but its isomer, fulvene is yellow. How will you explain it?
- 12. Draw the EPR spectrum of methyl free radical.

Section B: Short essay question. *All* questions can be answered. Each carries *four* weightage (Ceiling 12 weightage).

- 13. Show that for a rigid diatomic rotor the moment of inertia is given by $I = \mu r^2$.
- 14. State and illustrate with suitable potential energy curves the Frank-Condon principle in the vibrational spectrum of a diatomic molecule.
- 15. Discuss the relaxation process in magnetic resonance spectroscopy.





- 17. Write notes on chemical shift reagents with suitable examples.
- 18. (a) How will you distinguish between ethyl amine, diethyl amine and triethyl amine on the basis of mass spectroscopy?
 - (b) Give the typical fragmentation pattern in benzyl methyl ether.
- 19. Write short notes on HMBC and HMQC.

Section C: Essay questions. *All* questions can be answered. Each carries *six* weightage (Ceiling 12 weightage).

20. An organic compound A with molecular formula C₃H₇NO gives the following spectral data:

UV: λ_{max} 238nm, ϵ_{max} =10500

IR: 3428 cm⁻¹, 2940-2855cm⁻¹,1681 cm⁻¹, 1452cm⁻¹

¹HNMR: δ 1.87 (1H, singlet), 7.30 (3H, singlet), 8.1 (3H, singlet).

Deduce the structure of compound A giving reasons.

- 21. Discuss the theory of ESR spectroscopy and explain the hyperfine splitting shown by 'NH radical in its spectrum.
- 22. Outline the principle of Mossbauer spectroscopy. Explain the application of this technique in the study of Fe (II) and Fe (III) cyanides.
- 23. Describe the important features of mass spectra of the following.
 - (i) Aldehydes
- (ii) Ketones
- (iii) Alcohols
- (iv) Amides