Reg. No ..... Name **23P2033**

M. Sc. DEGREE END SEMESTER EXAMINATION : MARCH 2023

SEMESTER 2 : CHEMISTRY / PHARMACEUTICAL CHEMISTRY

COURSE : **21P2CHET07 / 21P2CPHT07: PHYSICAL CHEMISTRY - II**

(For Regular - 2022 Admission and Supplementary - 2021 Admission)

Duration : Three Hours Max. Weights: 30

PART A

Answer any 8 questions **Weight: 1**

1.	Describe Born-Oppenheimer approximation.	(U, CO 3)
2.	Where Is the Intensity Maximum in a Pure Rotational Spectrum?	(A, CO 2)
3.	What are combination band and difference bands?	(U, CO 2)
4.	Write a note on predissociation spectra	()
5.	(a) Give the properties of laser radiation. (b) Give any two examples of simple laser system. (c) Mention any four applications of lasers in chemistry.	()
6.	Explain the three dimensional orientations of radiofrequency energy and net magnetization using cartesian coordinate axis?	(U, CO 2)
7.	What is non first order spectra?	(R, CO 2)
8.	Explain why in a doublet of ^{1}H NMR spectrum the relative peak areas are in the ratio of 1:1?	(An, CO 2)
9.	Does ^{19}F exhibit nuclear magnetic resonance? Why?	(An, CO 2)
10.	What is zero field splitting?	()

(1 x 8 = 8)

PART B

Answer any 6 questions **Weights: 2**

11.	Consider a gas of atoms at T=300K, P=100 torr and mass of each atom is 4.2×10^{-27} kg. Some atoms in the excited state emit radiation of frequency υ. Estimate the amount of Doppler broadening.	(A, CO 3)
12.	For the linear molecule nitrous oxide, N_2O, predict which rotational energy level will be most populated for a temperature of 300 K. The rotational constant of nitrous oxide is 0.419 cm^{-1}.	(A, CO 2)
13.	Explain Stark effect in rotational spectra of a molecule. Outline the importance of Stark effect studies in microwave spectroscopy.	(U, CO 2)
14.	What vibrational frequency in wave number corresponds to a thermal energy of kT at 298K? Also calculate the wavelength of this radiation.	(A, CO 2)
15.	Explain Karplus equation in NMR spectroscopy?	(An, CO 2)
16.	Explain the theory of spin-spin splitting in NMR spectroscopy?	(U, CO 2)

17. Explain the term “resonance” in Nuclear Magnetic Resonance Spectroscopy? (R, CO 2)

18. How do electronegativity, spin state, and strength of ligand affect Mossbauer spectra of compounds? (An)

(2 x 6 = 12)

PART C

Answer any 2 questions **Weights: 5**

19. Briefly describe:
(a) Instrumentation of IR spectrometer.
(b) Sample preperation procedures in IR (U)

20. (a) State and illustrate with suitable potential energy curves, the frank-condon principle in the vibronic spectrum of a diatomic molecule. Briefly discuss
(b) Predict the kind of electronic transitions in (i) Cl_2 and (ii) C = O group. Also give their intensity. ()
(c) What is meant by population inversion? Mention any one method of achieving it.

21. a) Draw the splitting pattern of ^1H NMR peaks in 1,1,2-Trichloroethane?
b) Explain AMX spin system with an example? (R, CO 2)

22. Describe in detail the principle and characteristics of Mossbauer Spectroscopy with necessary diagrams and examples. (An, CO 4)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 2	Define aspects of specific spectroscopic techniques, applications of molecular symmetry in spectroscopy	A	2, 3, 6, 7, 8, 9, 12, 13, 14, 15, 16, 17, 21	23
CO 3	Understand the fundamental concepts of light-matter interaction, lasers and laser systems, detectors and other relevant aspects of instrumentation necessary for spectroscopy and imaging.	U	1, 11	3
CO 4	Ability to understand theory and application to mass spectrometry, ultraviolet and visible spectroscopy, infrared spectroscopy, Raman, fluorescence, nuclear magnetic resonance spectroscopy.	U	22	5

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;