Reg. No .... Name **18P233**

M Sc DEGREE END SEMESTER EXAMINATION - APRIL 2018
SEMESTER 2 : CHEMISTRY / PHARMACEUTICAL CHEMISTRY
COURSE : **16P2CHET07 / 16P2CPHT07 ; PHYSICAL CHEMISTRY - II**
(Common for Regular - 2017 Admission & Supplementary - 2016 Admission)

Time : Three Hours Max. Marks: 75

Section A
Answer any 10 (2 marks each)

1. What is the essential condition for a molecule to absorb microwave radiation?
2. What is meant by rigid rotor?
3. What are combination bands in vibrational spectra?
4. What is an asymmetric top molecule? Explain using moment of inertia.
5. Why vibrations involving relatively neutral bonds such as C-C, C-H, C=C are strong Raman scatterers while they are weak in IR absorption?
6. What is the principle of Electron Spectroscopy for Chemical Analysis (ESCA).
7. Draw the EPR spectrum of methyl free radical.
8. Explain exchange phenomena in NMR?
9. Explain precessional frequency in NMR spectroscopy?
10. Discuss Zeeman splitting with an example.
11. Define coupling constant J?
12. What is meant by shielding and deshielding of a nucleus?
13. Which of the following will show ESR spectra and why?
    (a) N_2 (b) H_2 (c) O_2 (d) Cu^{2+} (e) Cu^{+} (f) H

(2 x 10 = 20)

Section B
Answer any 3 (5 marks each)

14. What are polarized and depolarized Raman lines? Explain the origin of polarized Raman lines with an example.
15. Write briefly on the classification of molecules based on the principal moment of inertia.
16. What is meant by Laser action? What are the conditions to achieve it?
17. Explain how Mossbauer spectroscopy is useful in understanding electronic structure of molecules?
18. Explain (i) electric quadruple moment of a nucleus and (ii) electric field gradient of a nucleus?

(5 x 3 = 15)

Section C
Answer any 2 (5 marks each)

19. The rotational Raman spectrum of H_2 gas is found to consist of a series of Stokes and anti-Stokes lines, the first of it appears at 3459cm^{-1} relative to the source of excitation. Calculate the bond distance of H_2.
20. 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}.

21. (a) How many hertz does 1 ppm correspond to, for a ^{1}H NMR instrument operating at a radiofrequency of 60 MHz?
(b) The magnetic field (in Tesla) required for flipping a ^{1}H nucleus in an NMR spectrometer operating at 400 MHz is . . . . . . [Given: Υ = 2.67 $\times$ 10^8 T^{-1} s^{-1}, π = 3.14]

22. A particular NMR instrument operates at 60 MHz; what magnetic fields are required to bring ^{1}H and $^{13.}$C nuclei to resonate at this frequency? (h = 6.626 x 10^{-34}, ß = 5.051 x 10^{-27} JT^{-1}, "g" for ^{1}H = 5.585, "g" for ^{13}C = 1.404)

(5 x 2 = 10)

Section D
Answer any 2 (15 marks each)

23. Explain the microwave spectrum of a nonlinear polyatomic molecule.
24. Write on the Vibrational-rotational spectra of diatomics showing the origin of P branch and R branch of lines
25. Explain the application of Mossbauer spectroscopic techniques in the study of Fe (II) and Fe (III) cyanides
26. a) Discuss relaxation methods in NMR spectroscopy b) Discuss FTNMR

(15 x 2 = 30)