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ST—454—2022

FACULTY OF SCIENCE

M.Sc. (First Year) (Second Semester) EXAMINATION

MAY/JUNE, 2022

(New/CBCS Pattern)

CHEMISTRY

Paper–CH-424

(Analytical Chemistry/Principles of Spectroscopy)

(Wednesday, 6-7-2022) **Time : 9.30 a.m. to 1.15 p.m.**

Time— 3.45 *Hours* *Maximum Marks*—75

N.B. :— (*i*) Attempt *all* questions.

(*ii*) Use of calculator or logarithmic table is allowed.

(*iii*) Constants :

$c = 3 \times 10^8$ m/s

$h = 6.626 \times 10^{-34}$ Js.

1. Attempt any *three* of the following : 15

(*a*) Give an account of intensity of spectral lines.

(*b*) The molecule H_2 is microwave inactive while HCl is microwave active. Explain. Write a note on nuclear and electron spin interaction.

(*c*) The pure rotational spectrum of the gaseous molecule CN consist of a series of equally spaced lines separated by 3.7978 cm^{-1}. Calculate the internuclear distance of the molecule.

[^{12}C = 12.011 and ^{14}N = 14.007 $g.mol^{-1}$]

(*d*) How will you obtain photoelectron spectrum.

(*e*) Give the use of NMR in medical diagnosis.

2. Answer any *three* of the following : 15

(*a*) Give an account of polarization and scattering of light radiation.

P.T.O.

(*b*) If the internuclear distance of AB molecule is 1.20×10^{-10} m, calculate the raotational constant.

($A = 1.60 \times 10^{-27}$ kg and $B = 5.80 \times 10^{-27}$ kg)

(*c*) Explain pure rotating Raman's spectra.

(*d*) Give an account of vector representation of momenta.

(*e*) Comment on the princple of NQR spectroscopy and state its significance.

3. (*a*) What is Raman effect ? Explain pure rotational Raman spectrum. 8

Or

Explain the spectra of diatomic molecule as a simple harmonic oscillator. Give an account of metal-ligand vibrations.

(*b*) Describe electronic transitions in electronic spectrocopy. Explain charge transfer spectra. 7

Or

Explain electric field gradient and quadrupole moments. Give applications of NQRS.

4. (*a*) (*i*) Explain spin-spin interactions. 8

(*ii*) Give an account of AMX splitting.

Or

Give an account of hyperfine interactions.

(*b*) Discuss the principle of NMR spectra. How chemical shift can be measured ? 7

Or

(*i*) Explain Resonance Raman Sepctrum.

(*ii*) Give the factors affecting the band position and intensities.

5. Write short notes on any *three* of the following : 15

(*a*) Spin-spin interaction/coupling

(*b*) Charge Transfer Spectra

(*c*) Application of ESR Spectroscopy

(*d*) Koopman's Theorem.

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