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MEB-4719 Seat No._____

M. Sc. (Sem. I) Examination

November / December - 2018

CHN - 404(A) : Group Theory, Spectroscopy & Diffraction Methods

Time : 2 Hours] [Total Marks : 50

1 Answer any **two** : 20

(a) Explain all the terms : Character, Order of a group, Mullikan symbols, similarity transformation.

(b) Find $\overline{str}$, $\overline{in}$ planebending and $\overline{out}$ at plane bending for $[Ni(CN)_4]$ (square planar) and show their IR and Raman activity.

(c) Explain Boltzman Distribution law. Illustrate spectral line broadening.

(d) Discuss rotational, vibrational and electronic energy levels. Draw and describe Morse energy diagram.

2 Give the answers of any **three** : 20

(a) Explain applications of Mossbauer spectroscopy. Discuss quadrupole splitting.

(c) Give an account of paramagnetic Mossbauer spectra. How can you distinguish high spin and low spin compounds using Mossbauer spectroscopy ?

(c) Illustrate the use of Debye-Scherrer method for crystal analysis.

(d) Considering the example of Naphthalene, explain atomic coordinates and their inversion.

(e) Give an account of structure factor. What is phase problem ? Give its connection to Fourier synthesis.

3 Answer any **five** in brief : **10**

(a) Describe the concept of direct product and its utility.

(b) What is goniometer ?

(c) Discuss what is electric field gradient.

(d) Using x-ray diffraction, how can you find a rhombohedral crystal ? Give parameters and lattice symmetry of rhombohedral crystal.

(e) Explain nuclear quadrupole. Name at least three nuclei with quadrupolar system.

(f) Distinguish between subgroup and class.

(g) Write the statement of the great orthogonality theorem.

(h) Give one example of molecules having following symmetry point groups : D_{2d}, C_s, Ih, S_4.

(i) Explain dispersion and polarization of light.

(j) Give the statement of Born Oppenheimer approximation.