Printed Pages – 1

PYC-401

M. Sc. (Fourth Semester) Examination, 2020

(CBCS Course)

PHYSICS

Paper : First

(Atomic and Molecular Physics)

Maximum Marks : 60

Note: *Attempt all questions. Each question carries equal marks.*

1. Describe spin-orbit interactino and coupling scheme. Describe Hartree and Hartree fock method.

2. (a) Differentiate types of molecules on the basis of rotation. What are the factors respnosible for intensity of rotational lines.

(b) Discuss in detail the energy level and spectra of non-rigid rotator.

3. Explain the vibrational spectra of diatomic molecule under harmonic and anharmonic oscillating conditions. Discuss the spectra of diatomic vibrating-rotator molecule. Discuss PQR branches.

4. (a) Discuss in detail the pure rotational and vibrational Raman spectroscopy.

(b) Explain and principal and discuss the technique and instrumentation of NMR spectroscopy.

5. Attempt any **two** of the following :

(a) Explain qualitatively the hyperfine structure.

(b) The first line (J = 0) in the rotation spectrum of CO is observed as 3.84235 cm^{-1}. Calculate rotational constant and moment of intertia.

(Given, h = 6.626 × 10^{-34} Js ; C = 2·998 × 10^{8} ms^{-1})

(c) How many normal modes of vibrations are possible for the molecules HBr, SO_2 (bent) and C_6H_6.

(d) Explain photo electron spectroscopy.