MODEL QUESTION PAPER

END SEMESTER EXAMINATION – 2020

M.Sc. SEMESTER-II

**Core Course-5**

Sub – **Group Theory and Spectroscopy** Time – **2 Hour**

Paper – **CC-5**  Total Marks – **70**

**Group-A**

**Answer any two questions.**

1. Draw clean diagram to determine Point Group of following molecules.

(i) CHCl3 (ii) C2H6 (Eclipsed) 10

2. Construct the table of conjugates for C3V point group and show the number of classes in the

group. 10

3. Discuss the effect of isotopic substitution on the spectrum of rigid diatomic rotor in

microwave region. 10

4. Write the rotational energy of a non rigid diatomic rotator. Show that the spacing between

two consecutive spectral lines in this case is given by the expression 2B-4D(3J2+9J+7) where

B, D and J have their usual meanings. 10

**Group-B**

**Answer any two questions.**

5. Construct character table for C2V point group by using the Great Orthogonality theorem.

25

6. Vibrational spectrum of X2Y with Y as a central atom, exhibit three bands at 3756

cm-1, 3562 cm-1 and 1595 cm-1 respectively. Determine structure of the molecule. 25

7. Deduce equation for determining rotational energy levels of a diatomic molecule. Show that

spacing of the rotational energy levels are in arithmetic progression. 25

8. (a) Discuss the quantum theory of Raman spectroscopy and show how the Stokes and anti-

Stokes lines appears in the Raman spectrum of a molecule

(b) The pure rotational spectrum of the gaseous CN molecule consists of a series of

equally spaced lines separated by 3.7978 cm-1. Calculate the internuclear distance

of the molecule. The molar masses are, 12C=12.01 and 14N=14.007 gmol-1. 15+10