PAR-003-020202   Seat No. _____

M. Sc. (Physics) (Sem. II) Examination

August / September - 2020

CT-6 : Atomic and Molecular Physics

Faculty Code : 003

Subject Code : 020202

Time : $2\frac{1}{2}$ Hours]   [Total Marks : **70**

Instructions : (1)   All questions carry equal marks.

(2)   Full marks are indicated at the right end of each question.

(3)   Symbols have their usual meanings.

1   Answer Any **Seven** of the following :   **14**

(a)   Write down Schrodinger's r equation and its solution.

(b)   What is the physical meaning of different m values?

(c)   State Pauli's exclusion principle. Why the name "exclusion principle" is given?

(d)   What is anomalous Zeeman Effect?

(e)   What are the rigid and the non-rigid rotators?

(f)   Differentiate the Symmetric Tops and the Asymmetric Tops.

(g)   What quantum numbers J and K represent?

(h)   What are the Near Prolate and the Near Oblate Asymmetric rotors?

(i)   What is the commonly used unit of frequency in Vibrational Spectroscopy?

(j)   What is "Klystron" ? Where is it used?

2 Answer Any **Two** of the following :

(a) Discuss the interpretation of the result of Schrodinger 7
equation regarding dependence of wave function on the
angles θ and φ.

(b) Discuss Paschen Back Effect in detail. 7

(c) Convert the equation $\dfrac{\partial^2 \Psi}{\partial x^2}+\dfrac{\partial^2 \Psi}{\partial y^2}+\dfrac{\partial^2 \Psi}{\partial z^2}+\dfrac{8\pi m}{h^2}\left(E-V\right)=0$ 7

in spherical coordinates and derive the equation for r,

θ and φ.

3 (A) What do you mean by coupling scheme? Discuss j-j 7
coupling in detail.

(B) What is Stark effect? Discuss its experimental 7
arrangement with figure and its main feature.

OR

3 (A) Discuss the interaction of radiation with rotating 7
molecule in detail.

(B) Discuss Non-rigid Rotator in detail. Also compare the 7
energy levels and spectrum of rigid and non-rigid
rotators.

4 Answer the following questions :

(A) Discuss the first order Stark Effect of a Symmetric 7
Top Molecule for the $J=1, K=1 \rightarrow J=2, K=1$
transition.

(B) Explain the working of a Microwave Spectrometer 7
with the help of a block diagram.

5 Write a Short-note on Any **Two** of the following :

(A) Diatomic Vibrating Rotator 7

(B) IR Spectrophotometer 7

(C) Normal Vibrations of CO_2 and H_2O molecules 7

(D) Different series in alkali spectra 7

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