Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
(Autonomous)
End Semester Examination: OCT / NOV 2024
Faculty: Science and Technology

Program: B.Sc **Semester: V** **SET: A**
Program (Specific): General 03 **Course Type:**
Class: T.Y.B.Sc **Max.Marks: 35**
Name of the Course: Atomic and molecular physics
Course Code: 24 PHY-354 **Time: 2Hr**
Paper: IV

Instructions to the candidate:

1) *There are 4 sections in the question paper. Write each section on separate page.*
2) *All Sections are compulsory.*
3) *Figures to the right indicate full marks.*
4) *Draw a well labelled diagram wherever necessary.*

SECTION: A

Q1) (Multiple Choice Question) **5**

1) As quantum number increases, the difference of energy between consecutive energy levels……..
   a) remain same b) increases
   c) decreases d) sometimes decreases and sometimes ncreases
2) No two electrons in an atom can have the same set of four quantum numbers is…..
   a) Newtons law b) Bohr's law
   c) Hund's rule d) Pauli's exclusion principle
3) Zeeman effect is the splitting of spectral line in the presence of……
   a) electric field b) magnetic field
   c) inert environment d) vacuum
4) Splitting of spectral lines when atoms are subjected to strong electric field is called….
   a) Zeeman effect b) Stark effect
   c) photoelectric effect d) Compton effect
5) Raman effect is scattering of …..
   a) atoms b) molecules
   c) protons d) photons

Q2) Answer the following (Attempt any 4) **4**

i) what is quantum state of an electron
ii) what is the L value for state $^2D_{3/2}$
iii) what is Zeeman effect

iv) what are three major types of molecular spectra

v) In the Rutherford Alpha scattering experiment what is the material of foil

vi) What is Bohr Magneton

SECTION: B

Q3) Short answer questions (Attempt any 4) 8

i) What is vibrational quantum number.
ii) In which region pure rotational spectra lie.
iii) What is Rayleigh line
iv) What are stoke's and anti-stokes lines

v) What is Bohr first postulate of hydrogen atom

vi) State Lande interval rule

SECTION: C

Q4) Long answer questions (Attempt any 2) 8

i) Determine the ground state of aluminium ($_{13}$Al) atom. Represent it using the spectral notations.
ii) Write a note on space quantization
iii) With neat diagram explain experimental set up to produce and observe Raman effect
iv) Calculate the value of electronic angular momentum of a one-electron atom in the state $^2D_{5/2}$

SECTION: D

Q5) Long answer type Questions (Attempt any 2) 10

i) Show that for a rigid diatomic molecule, Ej = $\frac{j\,(j+1)\,\hbar^2}{2\,I}$

ii**)** Explain experimental set up of Stark effect.
iii) Explain L-S coupling scheme for two valence electron systems using neat vector digram

iv) A compound is irradiated by 4358 Å line of a mercury. Raman lines are observed at wavelengths 4420 and 4620 Å. Compute the value of Raman shift for each line in terms of wave number.
