Exam Seat No:_____ Enrollment No:_____

C.U.SHAH UNIVERSITY

Wadhwan City

Subject Code : 5SC02PHC2 **Summer Examination-2014** **Date: 11/06/2014**

Subject Name Atomic & Molecular Physics

Branch/Semester:- M.Sc(Physics) /II **Time:2:00To 5:00**

Examination: Regular

Instructions:-

(1) Attempt all Questions of both sections in same answer book / Supplementary

(2) Use of Programmable calculator & any other electronic instrument is prohibited.

(3) Instructions written on main answer Book are strictly to be obeyed.

(4) Draw neat diagrams & figures (If necessary) at right places

(5) Assume suitable & Perfect data if needed

SECTION-I

Q. 1 **Answer All the following Questions** **07**

1. Write down the azimuthal angle equation. 01
2. Write the Schrodinger equation in spherical co-ordinates for hydrogen atom. 01
3. What is Pauli's exclusion principle? 01
4. What are the quantum rules to form J? 01
5. What are quantum numbers to define electrons in atom? 01
6. What is Zeeman effect? 01
7. Define symmetric top molecule. 01

Q.2 A. The first rotational line of $^{12}C^{16}O$ is observed at 3.84235 cm^{-1} and that of $^{12}C^{16}O$ at 3.67337cm^{-1}. Calculate the atomic weight of ^{13}C. Assuming the mass of ^{16}O to be 15.9949. 05

B. What is the change in rotation constant B when hydrogen is replaced by deuterium in the hydrogen molecule? 05

C. Discuss the significance of rotational spectra. 04

OR

Q.2 A. What is the effect of isotope on rotational spectra?Describe 05

B. Rotational and centrifugal distortion constant of HCl molecule are 10.593cm^{-1} and 5.3x$10^{-4}cm^{-1}$ respectively. Estimate the vibrational frequency and force constant of the molecule. 05

C. Explain stark effect in briefly. 04

Q.3 A. Write Explanatory note on ' L-S coupling'. 07

B. Explain the energy level and spectrum of non-rigid rotors. 07

OR

Q.3 A. Show $[H, L_z] = 0$. 07

B. Write the polar angular equation and solve it for hydrogen atom. 07

SECTION-II

Q. 4 **Answer All the following Questions** **07**

1. Draw the normal modes of water molecules. 01
2. What are stretching and bending modes? 01
3. Divide the region wise IR spectroscopy. 01
4. Write the principle of IR detectors. 01
5. Write the principle of microwave detectors. 01
6. Write the expression for fundamental frequency of vibration. 01
7. What is zero point energy? 01

Q.5	A.	Discuss vibration energy of diatomic molecule.	05
	B.	Explain Morse curve and energy level of diatomic molecule.	05
	C.	What are P and R branch in diatomic vibrating molecule.	04

OR

Q.5	A.	Differentiate unit cell and site symmetry approach.	05
	B.	Discuss about normal mode of vibrations in crystal.	05
	C.	Explain diatomic molecule.	04

Q.6	A.	Write the functional part source and measurement of frequency of microwave spectrometer .	07
	B.	Derive the expression of for zero point energy for vibration energy of diatomic molecule.	07

OR

Q.6	A.	Explain IR spectrometer.	07
	B.	Write the functional part guidance, sample cell and detectors of microwave spectrometer .	07

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