



M 25141

Reg. No. :

Name :

II Semester M.A./M.Sc./M.Com. Degree (Reg./Sup./Imp.)
Examination, March 2014
PHYSICS
PH 204 : Atomic and Molecular Spectroscopy

Time: 3 Hours

Max. Marks : 50

SECTION – A

Answer **any two** questions. **Each** question carries **10** marks **each**.

1. Describe the Stern-Gerlach experiment to demonstrate the space quantization.
2. Explain the anomalous Zeeman Effect and hence explain the splitting of sodium D lines.
3. Discuss the rotation spectra of linear polyatomic molecules.
4. With a block diagram explain ESR spectrometer.

SECTION – B

Answer **any five** questions. **Each** question carries **3** marks.

5. What is hyperfine splitting of spectral lines ? Briefly explain it.
6. What is mutual exclusion principle ?
7. What is meant by Stark effect ?
8. How can the structure of CO_2 molecule be determined using IR and Raman spectra ?
9. What is the effect of isotopic substitution on rotational spectra of molecules ?
10. Define hot bands. Derive the expression for its wave number.
11. What are LS and JJ coupling ?

P.T.O.



SECTION – C

Answer **any three** questions **each** question carries **five** marks.

1. Calculate the first three lines in the absorption spectrum arising from the 3s level of hydrogen atom. What is the ionization energy of this level ?
2. Which type of spectroscopy would one observe in the pure rotational spectrum of H_2 ? If the bond length of H_2 is 0.07417 nm what would be the spacing of lines in the spectrum ?
3. The equilibrium vibration frequency of iodine molecule is 215cm^{-1} and an anharmonicity constant is 0.003 at 300 K what is the intensity of the hot band ($v = 1$ to $v = 2$ transition) relative to that of the fundamental ($v = 0$ to $v = 1$) ?
4. HCl has B value 10.593cm^{-1} and centrifugal distortion constant D of $5.3 \times 10^{-4}\text{cm}^{-1}$. Estimate the vibrational frequency and force constant of the molecule.
5. Rotational constant for HCl^{35} is observed at $10.59.9\text{cm}^{-1}$. What are the B values for HCl^{37} and DCl^{35} ?