

Roll No.

Total Pages : 3

235503

December, 2019

**B.Sc. Physics - V SEMESTER
Atomic Molecular Physics (DECP-501)**

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART - A

1. (a) Differentiate continuous and characteristic X-ray. (1.5)
(b) What is Paschen-Back effect? (1.5)
(c) Explain Moseley Law. (1.5)
(d) Find Lande's g factor for $2p_{3/2}$. (1.5)
(e) Define population inversion. (1.5)

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- (f) The exciting line is 4358 \AA and Stokes line is at 4458 \AA . Find the wavelength of anti-stokes line. (1.5)
- (g) Define metastable state. (1.5)
- (h) State Larmor's Theorem. (1.5)
- (i) What is meant by space quantization? (1.5)
- (j) Explain the significance of critical potential. (1.5)

PART - B

2. (a) Obtain an expression for the total energy of hydrogen atom using Bohr's theory. Hence determine the wavelength range of Balmer series. (10)
- (b) Discuss the origin and mechanism of the production of X-rays. (5)
3. (a) The moment of inertia of the CO molecule is $1.46 \times 10^{-46} \text{ kg-m}^2$. Calculate lowest rotational energy in eV. (5)
- (b) Discuss vibrational spectra of diatomic molecules. Draw energy level diagram. (10)
4. (a) What is Normal Zeeman effect? On the basis of quantum theory, explain the effect of magnetic field on the energy levels of atom. (10)

- (b) Explain the splitting of spectral line in Normal Zeeman effect for $^1F \rightarrow ^1D$ transition. (5)
5. (a) Explain j-j coupling. Determine all the possible terms under the j-j coupling of an s-state electron with f-state electron. (10)
- (b) Discuss the principle and significance of Stern-Gerlach Experiment. (5)
6. (a) Discuss the principle and working of a He-Ne laser. (10)
- (b) What is an advantage of four level laser over three level laser? Give *one* example for each case. (5)
7. (a) Distinguish between spontaneous and stimulated emission of radiation. Derive Einstein coefficients. (10)
- (b) Explain Raman effect and discuss selection rule. (5)