



**24517**

**Fifth Semester B.Sc. Degree Examination, November/December 2016**

**PHYSICS – V**

**Paper – 5 [5.1] : Atomic and Molecular Physics (New Syllabus)**

Time : 3 Hours

Max. Marks : 80

**Instructions :** 1) Answer all questions from Section – A, any five from Section – B and any four from Section – C.  
2) Write answers to Section – A questions in first two pages only.

**SECTION – A**

I. Answer the following : **(15×1=15)**

- 1) How many electrons are excess on a liquid drop whose charge is – 1.6 nc ?
- 2) Mention any one use of Mass Spectrograph.
- 3) Define impact parameter.
- 4) What are stationary orbits ?
- 5) What will be the energy of emitted photon when electron in hydrogen atom jumps from 10<sup>th</sup> orbit to the ground state ?
- 6) What is the value of the orbital quantum number for which the orbit is always spherical ?
- 7) State Pauli's exclusion principle.
- 8) Name the smallest unit of magnetic dipole moment.
- 9) Which idea of vector atom model is useful to explain the anomalous Zeeman effect ?
- 10) State Franck – Condon principle.
- 11) Mention any one use of Raman effect.
- 12) Name the type of molecular spectra observed in the far infrared region.
- 13) Which type of spectrum is the characteristic of molecules ?
- 14) Why anti stokes lines are less intense than stokes lines ?
- 15) What is recorded on the hologram ?

**P.T.O.**



SECTION – B

II. Answer **any five** of the following : (5×5=25)

- 16) Derive the expression for the energy of the electron in the  $n^{\text{th}}$  Bohr orbit, assuming the expression for the radius of hydrogen atom.
- 17) Discuss L-S coupling scheme.
- 18) Discuss the two distinct features of vector model of atom.
- 19) Explain the main features of continuous X-ray spectrum and Duane-Hunt Limit.
- 20) Classify the molecular spectra and briefly explain each of them.
- 21) What is meant by population inversion and pumping ? Mention the types of pumping.
- 22) Describe the experimental set up used to study Raman effect.

SECTION – C

III. Answer **any four** of the following : (4×10=40)

- 23) Describe J. J. Thomson's method of determining the specific charge of the electron with necessary theory. 10
- 24) a) Derive expression for the radius of  $n^{\text{th}}$  orbit of electron from Bohr's theory. (6+4)  
b) Calculate the radius of 3<sup>rd</sup> Bohr orbit using constant values for singly ionized helium atom.  
 $m_e = 9.1 \times 10^{-31} \text{ kg}$ ,  $h = 6.625 \times 10^{-34} \text{ J.s}$ ,  $e = 1.6 \times 10^{-19} \text{ C}$
- 25) Describe the Stern-Gerlach experiment and indicate the importance of the results obtained. <https://www.vskub.com> 10
- 26) a) Discuss the rotational spectrum of diatomic Molecule treating diatomic molecule as rigid rotator.  
b) In the CO molecule the wave number difference between successive absorption lines in the pure rotational spectrum is  $3.84 \text{ cm}^{-1}$ . The reduced mass of CO molecule is  $1.138 \times 10^{-26} \text{ kg}$ . Calculate the moment of inertia and equilibrium bond length of molecule. (7+3)
- 27) a) Discuss how quantum theory is successful in explaining Raman effect.  
b) Describe the construction and working of Ruby laser. (5+5)
- 28) Discussing absorption, spontaneous and stimulated emission, get the relationship between Einstein's coefficients. 10