Reg. No..... Name.....

BSc DEGREE END SEMESTER EXAMINATION MARCH 2017

SEMESTER – 6: PHYSICS (CORE COURSE)

COURSE: U6CRPHY12 –: RELATIVITY AND SPECTROSCOPY

(For Regular - 2014 Admission)

Time: Three Hours Max. Marks: 60

PART A

(Answer **all** questions. Each question carries 1 mark.)

1. Define reduced mass of a molecule.

2. What is Raman Shift?

3. Find L, S, and J value for the state $^2P_{\frac{3}{2}}$.

4. The value of Bohr radius is ..... nm.

5. Bracket and Pfund series of hydrogen spectrum lie in the ..... region of electromagnetic spectrum.

6. The projection of the orbital quantum number on the magnetic field direction is called.....

7. What is Stark effect?

8. Symmetric polyatomic molecules do not exhibit rotational spectra. Why?

9. State Pauli's exclusion principle.

10. What is Bohr magneton?

(1 x 10 = 10)

PART B

(Answer **any seven** questions. Each question carries 2 marks.)

11. What is Larmor precession?

12. What is vibrational-rotational spectrum?

13. In Raman Spectra, Stokes lines are more intense than anti-Stokes lines. Why?

14. Explain spin-orbit coupling.

15. Explain spatial quantisation.

16. What is meant by time dilation in relativity?

17. Explain the relativistic variation of mass of an electron in Sommerfeld's atom model.

18. What is Franck-Condon principle?

19. Differentiate between inertial and non-inertial frames of reference.

(2 x 7 = 14)

PART C

(Answer **any four** questions. Each question carries 4 marks.)

20. Explain j-j coupling scheme for two valence electron system using neat vector diagram.

21. A spectral line of wavelength $6000A^0$ when placed in a magnetic field of 10 Tesla is observed to a normal Zeeman triplet. Calculate wavelengths of the spectral lines.

22. At what speed is a particle moving if the mass is equal to three times its rest mass?

23. Find the series limit of Balmer series of hydrogen spectrum.

24. The difference between two successive absorption lines in pure rotational spectrum of hydrogen fluoride is $40.62cm^{-1}$. Calculate the equilibrium bond length of the molecule if its reduced mass is 1.577×10^{-27} kg.

25. For the $^2P_{1/2}$ state of the electron, calculate the possible values of m_j and J_z, J_z being the z- component of total angular momentum. Also find the possible orientations of J vector in space.

(4 x 4 = 16)

PART D

(Answer **any two** questions. Each question carries 10 marks.)

26. Obtain the Lorentz transformation equations for the coordinates in an inertial frame of reference. Write down the inverse transformation equations.

27. Obtain an expression for the energy levels of rigid diatomic rotator. And also deduce an expression for the wave number of possible transitions. Sketch the energy level diagram and rotational spectrum of the molecule.

28. Describe the Stern-Gerlach experiment with the help of necessary theory and experimental set up.Give its significance.

29. What is Zeeman Effect? Describe the experimental arrangement for studying Zeeman Effect. Use classical ideas to explain normal Zeeman effect.

(10 x 2 = 20)

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