B. SC. DEGREE (C.B.C.S.S) EXAMINATION, MARCH 2018
(2015 Admission Regular)
SEMESTER VI – CORE (PHYSICS)
PH6B12TB - RELATIVITY AND SPECTROSCOPY

Time : 3 Hours   **Maximum Marks : 60**

Part A

I. Answer all questions. Each question carries 1 marks   **(5x1=5)**

1. State the expressions for rest energy, kinetic energy and toatal energy of a relativistic particle.

2. What are inertial and non inertial frames of reference?

3. What is Larmor's theorem?

4. Why classical theory of Raman effect is discarded?

5. Describe Fluorescence?

Part B

II. Answer any Five questions. Each question carries 2 marks   **(5x2=10)**

6. Explain length contraction.

7. Explain relativistic momentum

8. Explain relativity of simultaneity.

9. What is Electron Spin resonance? Explain the energy levels associated with it.

10. Compare L-S coupling and j-j coupling scheme for addition of angular momenta.

11. Energy levels of rotational spectra are not equally spaced. But the rotational spectral lines are equidistant. Justify.

12. Explain N M R spectroscopy.

13. What is rotational constant? What is its unit?

Part C

III. Answer any Five questions. Each question carries 5 marks   **(5x5=25)**

14. At what speed is a particle moving is equal to three times of its rest mass?

15. A stationary object explodes into two fragments each of mass 1 Kg that move apart at speeds of 0.6c relative to the original body. Find the mass of original body

16. An electron (m $=0.511$ Mev/c2) and a photon (m=0) both have momenta of 2 Mev/c. Calculate the total energy of each.

17. Calculate the wavelength separation between the two component lines which are observed in the normal Zeeman effect . The magnetic field used is 0.6 weber/square meter. The specific charge $=1.76 \times 10^{11}$ Ckg-1 and wavelength=6000A. U

18. Find the electronic configuration for atom having atomic number 29. Explain.

19. In the near infrared spectrum of HCl molecule there is single intense band at 2885.9/cm. Assuming that it is due to the transition between vibrational levels, show that the force constant k is 480 N/m. (Given MH. $=1.68 \times 10^{-27}$Kg).

20. What is the change in the rotational constant B when hydrogen is replaced by deuterium in the hydrogen molecule?

21. Calculate the vibrational energy levels of an HCl molecule assuming the force constant to be 516 N/m

Part D

IV. Answer any Two questions. Each question carries 10 marks   **(2x10=20)**

22. Derive Lorentz transformation equations for co ordinates with needful explanation.

23. Describe Vector Atom Model.

24. Describe Stern Gerlach experiment and its results.

25. Describe Raman Scattering. Give theoretical explanations