B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH/APRIL 2012

Sixth Semester

Core Course—RELATIVITY AND SPECTROSCOPY

(Common for Model-I B.Sc. Physics, Model-II B.Sc. Physics, B.Sc. Physics-EEM and B.Sc. Physics Instrumentation.)

Time : Three Hours   Maximum Weight : 25

Part A

Answer all *questions.*
Objective type questions—Weight 1 *for each bunch.*

Bunch I

1. The Cartesian coordinate system attached to the reference fixed body is called a ——————.

2. Length contraction occurs only along the ———— of motion.

3. The nuclear magnetic resonance is in the ———————— frequency region.

4. Linear molecules are molecules in which ———————— the atoms are arranged in a straight line.

Bunch II

5. An inertial frame of reference is one in which a body moves with ———— velocity.

6. Twin paradox is associated with ————

7. The Zeeman effect is a clear confirmation of ———— **quantization**

8. Water ———— and vinyl chloride molecule are ———— **top molecule.**

Bunch III

9. The negative result of ———— experiment was the failure to observe any fringe shift.

10. The band spectrum has a number of ———— of different colors separated by regions

11. The magnitude of the angular momentum is an ———— multiple of $(h/2\pi)$

12. Raman scattering is due to collision between the ———— and the ———— of the scatterer.

Bunch IV

13. Simultaneity is not an ———— concept, but is a relative concept.

14. Incandescent gases and vapors of elements produce ———— spectra.

15. The magnetic moment of the silver atom was found to be equal to a ———— magneton.

16. The vibrational energy levels of a ———— molecule are equally spaced.

$(4 \times 1 = 4)$

Turn over

Part B (Short Answer Questions)

Answer **five** *questions.*
Weight 1 each.

17. What is an inertial frame of reference ?

18. Write down Lorentz transformation equations.

19. Explain time dilation.

20. What is exclusion principle ? Explain.

21. Briefly explain LS coupling.

22. What is ESR ?

23. Differentiate between phosphorescence and fluorescence.

24. What is Raman Effect ?

$(5 \times 1 = 5)$

Part C (Short essay / problems)

Answer **four** *questions.*
Weight 2 each.

25. Calculate the length of a rod of length one meter moving with a speed of 2.5×10^8 ms^{-1}.

26. What is the mean life of a meson travelling with a velocity 70% of the velocity of light. The proper mean life time is 2.2×10^{-8} s.

27. Calculate the energy of a gamma ray produced when an electron positron pair gets annihilated. The mass of the electron is 9.1×10^{-31} kg and c = 3×10^8 ms–1.

28. The moment of inertia of CO molecule is 1.46×10^{-46} kg m^2. Calculate the energy in eV.

29. The energy of a particular state of an atom is 5.36 eV and the energy of another state is 3.45 eV. Find the wavelength of the light emitted when the atom makes a transition from one state to the other.

30. The rotational spectrum of ^{79}Br^{19} F shows a series of equidistant lines 0.71433 cm^{-1} apart. Calculate the rotational constant B and hence the moment of inertia and bond length of the molecule.

$(4 \times 2 = 8)$

Part D (Essay)

Answer **two** *questions.*
Weight 4 each.

31. Describe Michelson-Morley experiment and explain the results.

32. Deduce mass velocity relation, considering the variation of mass with velocity.

33. Describe the theory and working of a double beam spectrometer for the infrared investigation.

$(2 \times 4 = 8)$