

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2015**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 (Objective Type Questions)*Answer all questions.**Each bunch of four questions carries a weight of 1.***Bunch I**

1. Accelerated frames are called _____ frames.
2. The special theory of relativity was proposed in the year _____.
3. The twin paradox is an example of _____.
4. In _____ effect the spectral lines are split up under the influence of magnetic field.

Bunch II

5. The orbits in Bohr atom model is _____.
6. The Stern-Gerlach experiment is an excellent proof of _____ quantization.
7. Vibrational energies produce _____ spectra.
8. The IR absorption line in Raman spectra in the frequency difference between modified and _____ line.

Bunch III

9. The lowest energy corresponds to _____ spectra.
10. ESR spectroscopy lies _____ region of the electromagnetic spectrum.
11. _____ is invariant under Galilean transformation.
12. A spinning electron about its axis behaves like a tiny magnet and possess _____ due to its spin.

Bunch IV

13. Velocity of light is _____ of the relative motion of the source and observer.
14. The Raman lines are _____ polarized.
15. Sodium D-lines are due to transition from _____ state to the _____ state.
16. Anomalous Zeeman effect can be explained only by using the idea _____ of the electron.

 $(4 \times 1 = 4)$ **Turn over**

Part B (Short Answer Questions)

Answer any five questions.

Each question carries a weight of 1.

17. Give the significance of Michelson-Morley experiment.
18. Define length contraction in relativity.
19. What is an absorption spectrum? Give an example.
20. State the postulates of Bohr atom model.
21. What is anomalous Zeeman effect?
22. Give the different molecular energies.
23. What is called Fluorescence?
24. Why classical theory of Raman effect fails?

(5 × 1 = 5)

Part C (Short Essay/Problems)

Answer any four questions.

Each question carries a weight of 2.

25. At what speed is a particle moving if the mass is equal to three times its rest mass?
26. Calculate the K.E. of an electron moving with a velocity 0.98 times the velocity of light in the laboratory system.
27. Describe about the quantum numbers associated with vector atom model.
28. Calculate the value of magnetic dipole moment due to spin $s = 1/2$.
29. Explain rotational spectra in terms of rigid rotator.
30. In the CO molecule the wave number difference between the successive absorption lines in the pure rotational spectrum is 384 cm^{-1} . Calculate the moment of inertia of the molecule and the equilibrium bond length of the molecule. The reduced mass of CO molecule is $1.138 \times 10^{-26} \text{ kg}$.

(4 × 2 = 8)

Part D (Essay)

Answer any two questions.

Each question carries a weight of 4.

31. Describe about composition of velocities in relativity and also explain the concept of mass energy equivalence.
32. With principle and experimental set up explain Stern-Gerlach experiment and give its significance.
33. What is vibrational Spectroscopy? Describe about infra red spectroscopy in detail.

(2 × 4 = 8)