Reg. No…….. Name…… **21U643**

B. Sc. DEGREE END SEMESTER EXAMINATION - APRIL 2021

SEMESTER **–6: PHYSICS (CORE COURSE)**

COURSE: **15U6CRPHY12: RELATIVITY AND SPECTROSCOPY**

(Common for Regular 2018 admission & Improvement 2017/Supplementary 2017 /2016 /2015/2014 admissions)

Time: Three Hours Max Marks: 60

PART A (Very short answer questions)

Answer all questions. Each question carries 1 mark

1. What are inertial frames of reference?
2. State the selection rules for L, S and J.
3. State the principle of equivalence in general theory of relativity.
4. What are Fraunhofer lines?
5. The series of hydrogen spectra which lies in the visible region of EM spectrum is ……
6. The spectra produced by white light, gas flame etc. are examples of …….
7. What is meant by wavenumber?
8. What is meant by zero-point energy?
9. Methane is an example of …… molecules.
10. Give an example for absorption spectra. (1 x 10 = 10)

PART B (Short answer)

Answer any Seven questions. Each question carries 2 marks

11. What did the Stern-Gerlach experiment establish?
12. What are the postulates of special theory of relativity?
13. What is Paschen Back effect?
14. What do you mean by time dilation?
15. State the postulates of Bohr atom model.
16. Explain Russel Saunders coupling.
17. Explain the phenomenon of luminescence.
18. What is ESR spectroscopy?
19. Why the intensity of Stoke's lines are more than the intensity of anti-Stoke's lines?

(2 x 7 = 14)

PART C (Problem/Derivations)

Answer any Four questions. Each question carries 4 marks

20. Explain the fine structure of H_α line of hydrogen spectra on the basis of vector atom model.
21. The length of one edge of a cube in a reference frame S is 1m. What will be its volume observed from a system S' which is moving with a velocity 2×10^7 m/s parallel to one edge of the cube.

22. The first absorption line in the rotational spectrum of CO appears at a frequency of 1.15×10^{11} Hz. Calculate the bond length of CO molecule. Given $M_C = 1.99 \times 10^{-26}$ kg and $M_O = 2.66 \times 10^{-26}$ kg.
23. Derive an expression for Zeeman shift observed in a normal triplet splitting.
24. At what speed should a clock be moved so that it may appear to lose one minute in each hour?
25. The length of a rocket is 100m, on the ground. While in flight, its length as observed on the ground is 99m. What is the speed of the rocket? (4 x 4 =16)

PART D (Long answer questions)

Answer any Two questions. Each question carries 10 marks

26. Derive the formula for relativistic variation of mass and hence deduce Einstein's mass-energy relationship.
27. Explain vector atom model. Write notes on various quantum numbers associated with vector atom model.
28. Describe the Michelson-Morley experiment. What was the result and what is the importance of the result?
29. What is Raman effect? Give the classical theory of Raman effect. Mention the demerits of classical theory.

(10 x 2 = 20)

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