(Pages : 4)

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Fifth Semester B.Sc. Degree Examination, February 2021

First Degree Programme Under CBCSS

Physics

Core Course V

PY 1541 – METHODOLOGY IN PHYSICS AND RELATIVISTIC MECHANICS

(2015-17 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

(Very short answer type questions). Answer **all** questions **1** mark each.

1. Mention any two factors that motivate research.
2. What is meant by quantitative research?
3. When is a probability sample recommended in research?
4. What are the characteristics of a good research report?
5. What is the physical significance of the Hamiltonian?
6. Write down the Hamilton's equations of motion.
7. Distinguish between inertial mass and relativistic mass of a particle.

8. When is an equation said to be invariant under a transformation?

9. What is meant by co-variant quantity with respect to a transformation?

10. Distinguish between inertial and non-inertial frames of reference.

(10 × 1 = 10 Marks)

SECTION – B

Short answer type questions. Answer **any eight** questions of **2** marks each.

11. What is meant by Ex post facto research?

12. Distinguish between research methods and Research methodology.

13. In the context of Research design, explain Experimental and control groups.

14. Define confounded relationship in the context of Research design.

15. When is an equation said to be invariant under a transformation?

16. Assuming Lorentz-Fitzgerald contraction, calculate the apparent length of a meter scale moving at a speed of 2.5×10^8 m/s.

17. Calculate the length of a rod moving with 0.8 times the velocity of light (c), in the *X-Y* plane inclined at an angle of 600 with the *X* axis. Given the proper length of the rod is 1 m.

18. What is the life time of a burst of $\pi+$ mesons travelling with a velocity of 0.7 times the velocity of light(c).The proper life time = 2.5×10^{-8} sec?

19. Two electrons in a stationary frame of reference move off with equal velocity 0.8 times the velocity of light (c) in opposite to the X axis. What is the velocity of one electron with respect to the other.

20. Find the energy equivalent to 1Kg of matter.

21. The length of a rocket is 100m on the ground. While on flight, its length as measured from the ground frame is 99m. What is the speed of the rocket?

22. Calculate the rest energy of an electron if the rest mass of the electron is 9.1×10^{-31} kg.

($8 \times 2 = 16$ Marks)

SECTION – C

Answer **any six** questions of **4** marks each.

23. Explain how errors are estimated and reported.

24. How do errors propogate in different mathematical operations?

25. How can errors in a measurement be minimised?

26. Research is concerned with proper fact finding, analysis and evaluation. Give reasons supporting this statement.

27. Using the relativity theory, arrive at the expression for variation of mass with velocity.

28. Derive Einstein's mass energy equivalence. Give suitable examples to prove this equivalence.

29. Explain the concepts of Lorentz transformation.

30. What is a Harmonic oscillator? Deduce the Hamilton's equations for a Harmonic oscillator.

31. (a) From D'Alembert's principle deduce Hamilton's principle.

    (b) From Hamilton's Principle deduce Lagrange's equations.

($6 \times 4 = 24$ Mar

SECTION – D

Answer **any two** questions. Each question carries **15** marks.

32. What are the main features of paper writing in research? Why is paper publication important in research?

33. Compare the Newtowan, Lagrangean year and namiltowar approach for a two dimensional harmonic oscillator. Which approach is more fruitful?

34. Distinguish between inertial and non-inertial frame of refenee. Deduce the Galdian transformation equations.

35. What are the basic ideas of errors measurement? Discuss the various types of errors.

(2 × 15 = 30 Marks)
