(Pages : 3) **F – 2470**

Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2018
First Degree Programme under CBCSS
PHYSICS
Core Course V
PY 1541 – Methodology in Physics and Relativistic Mechanics
(2014 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. **Each** question carries **one** mark :

1. What is the role of experimentation in scientific method ?
2. Define generalized momentum.
3. Give the Hamiltonian for a two dimensional harmonic oscillator.
4. Write down Hamilton's equations of motion.
5. What is meant an inertial frame ?
6. State the postulates of special theory of relativity.
7. What is meant by rest energy ?
8. Explain what is meant by length contraction.
9. Write down the relativistic energy – momentum relation.
10. What are tachyons ? **(10×1=10 Marks)**

P.T.O.

SECTION – B

Answer **Eight** questions **not** exceeding a paragraph. **Each** question carries **two** marks :

11. What is quantitative approach of research ?

12. What are the three groups in to which different methods of research can be put ?

13. Give the different criteria to be satisfied by a good scientific research.

14. What are the two types of experiments ?

15. What are cyclic coordinates ? Prove that the momentum conjugate to a cyclic coordinate is a constant of motion.

16. Give the conditions under which the hamiltonian function becomes the total energy of a system.

17. Write down the Galilean transformation equations.

18. Discuss the importance of the Michelson-Morley experiment.

19. Using energy-momentum relation, prove that a particle of zero rest mass always travel with the speed of light in vacuum.

20. Explain twin paradox.

21. Define the components of velocity four-vector.

22. Discuss how the time dilation of special relativity was tested experimentally.

(8×2=16 Marks)

SECTION – C

Answer **any six** questions. **Each** question carries **four** marks :

23. Discuss the general objectives of research.

24. Describe the different steps of scientific research.

25. Explain the concept of replication in the design of experiments.

26. In an experiment to determine the spring constant, the following values are obtained for the spring constant (in Newton/metre) : 86, 85, 84, 89, 85, 89, 87, 85, 82, 85.
    i) Find the mean value of spring constant.
    ii) Standard deviation of the values.

27. Prove that Hamiltonian function is a constant of motion if the Lagrangian is not an explicit function of time.

28. Write down the Hamiltonian for a one dimensional harmonic oscillator and obtain the equations of motion.

29. What is Coriolis force ? How does it affect motion of objects on earth ?

30. Calculate the apparent wavelength of a spectral line of wavelength $5000A^0$ in the light coming from a distant star which moves away from the earth at a recessional velocity of 3×10^7 m/s.

31. Calculate the velocity of nuclear particles whose mean life time is 4.17×10^{-8}s. Proper life time is 2.5×10^{-8}s. **(6×4=24 Marks)**

SECTION – D

Answer **any two** questions. **Each** question carries **fifteen** marks :

32. Discuss statistical testing of a hypothesis explaining null hypothesis, significance level in the statistics based acceptance or rejection of a hypothesis.

33. Describe the importance of estimating errors. Discuss random errors and systematic errors and their sources.

34. Outline the general format of a science journal paper with proper description of each component.

35. Using the conservation of momentum, arrive at the relativistic expression for variation of mass with velocity. **(2×15=30 Marks)**