

**THIRD SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2020**

Physics/Applied Physics

PHY 3B 03/APY 3B 03—MECHANICS

Time : Three Hours

Maximum : 80 Marks

Section A

Answer all questions.

Each question carries 1 mark.

Answer in a word or phrase.

1. A particle in uniform rectilinear motion corresponds to a straight world line. The relative position of one event with respect to another would be represented by _____.
2. A particle of _____ mass travels with the speed of light.
3. Work energy theorem is given by _____.
4. The configuration of the system of N particles, moving freely in space, may be represented by the position of a single point in 3N dimensional space, which is called _____.
5. The relation represents variation of mass with velocity is _____.
6. An inertial frame attached with the centre of mass of an isolated system of particles is called the _____.
7. Constraints are always related to forces which restrict the motion of the system. These forces are called _____.

True or False :

8. Lagrangian equations are invariant under Galilean transformation.
9. It is impossible to perform an experiment which will measure the state of uniform velocity of a system by observations, confined to that system.
10. All the laws of physics have the same form in all non inertial systems.

(10 × 1 = 10 marks)

Turn over

Section B

Answer all questions

Each question carries 2 marks.

Answer in two or three sentences.

11. What are the assumptions of Galilean transformations ?
12. State D alembert's principle ?
13. State Newton's law of action and reaction.
14. What is the negative results of Michelson-Morley experiment.
15. Explain conservation of energy in a particle.
16. State postulates of special theory of relativity.
17. Explain length contraction.

(7 × 2 = 14 marks)

Section C

Answer any five questions.

Each question carries 4 marks.

Answer in one paragraph.

18. Explain the advantages of lagrangian dynamics over Newtonian approach.
19. Deduce an expression for escape velocity.
20. Explain validity of Newton's law.
21. State and deduce Kepler 's second law of planetary motion.
22. Explain inertial frames of reference with example.
23. What you mean by ether hypothesis in relativity.
24. Explain twin paradox phenomena.

(5 × 4 = 20 marks)

Section D

Answer any four questions.

Each question carries 4 marks.

25. If $F = (2xy + z^2)\mathbf{i} + x^2\mathbf{j} + 2xz\mathbf{k}$ newton, then show that it is conservative. Calculate the amount of work done by this force in moving a particle from (0, 1, 2) to (5, 2, 7) m.
26. A clock keeps correct time. With what speed should it be moved relative to an observer so that it may seem to lose 2 minutes in 24 hours ?
27. Obtain the equation of motion of a simple pendulum by using Lagrangian method and hence deduce the formula for its time period for small amplitude oscillations
28. Calculate the speed of an electron which has kinetic energy 2 MeV.
29. The eccentricity of the earth's orbit is 0.0167. Calculate the ratio of maximum and minimum speeds of the earth in its orbit.
30. Write the Hamiltonian for a simple pendulum and deduce its equations of motion.
31. Determine the length and the orientation of a rod of length 10 metres in a frame of reference which is moving with 0.6c velocity in a direction making 30° angle with the rod.

(4 × 4 = 16 marks)

Section E

Answer any two questions.

Each question carries 10 marks.

32. Explain and deduce Hamilton's equations.
33. Briefly explain and deduce Inverse square law of planetary motion.
34. Explain conservation theorems and symmetry laws.
35. Explain Galilean transformation and deduce Galilean transformation equations.

(2 × 10 = 20 marks)