

D 14110

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Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION
NOVEMBER 2016

(UG—CCSS)

Physics

PH 3B 05—MECHANICS

(2013 Admissions)

Time : Three Hours

Maximum : 30 Weightage

Section A

Answer all questions.

Each question carries $\frac{1}{4}$ weightage.

- Lagrange's equations of motion are second order equations, the degrees of freedom for this are :
(a) $2n + 1$. (b) $2n$.
(c) $2n - 1$. (d) $2n + 2$.
- For attractive inverse square forces the shape of orbit is :
(a) Elliptic. (b) Parabolic.
(c) Hyperbolic. (d) All of these.
- Lorentz transformations assume :
(a) Space and time are both relative.
(b) Space is relative.
(c) Space is absolute but time is relative.
(d) Space and time are both absolute.
- The motion of one projectile as seen from another is :
(a) Circular motion. (b) Elliptical.
(c) Straight line. (d) Cylindrical.
- The instantaneous power acting on a particle is :
(a) F.P. (b) $F \times R$.
(c) F.V. (d) $F \cdot a_x$.
- The graph plotted between P.E and distance has :
(a) Elliptical shape. (b) Straight line.
(c) Hyperbolic shape. (d) Parabolic shape.

Turn over

7. The escape velocity of a body projected in the upward direction on the earth is :
 (a) 9.8 km/hr. (b) 11.2 km/hr.
 (c) 11.2 km/sec. (d) 7.98 km/sec.
8. Constraints that can be written in the form of inequality are called :
 (a) Lagrangian. (b) Holonomic.
 (c) Hamiltonian. (d) None of these.
9. The angular momentum of a particle moving under the action of a central force is :
 (a) $I\omega = PC$. (b) $J = r \times p$.
 (c) Zero. (d) $f = du/dt$.
10. Freely falling bodies deviate from their true vertical path due to the effect of :
 (a) Newton's force. (b) Coriolis force.
 (c) Galilean force. (d) Centripetal force.
11. When a particle moves under the action of a central force, its angular momentum is :
 (a) Not conserved. (b) Conserved.
 (c) Zero. (d) Infinite.
12. Constraints which can be absorbed in generalized co-ordinates are known as :
 (a) Holonomic. (b) Non holonomic.
 (c) Lagrangian. (d) Hamiltonian.

(12 × ¼ = 3 w)

Section B

Answer all questions.

Each question carries 1 weightage.

13. What are the limitations of the Newton's laws of motions ?
14. What is Pseudo force ?
15. What is energy Function ? Give its property.
16. Explain centre of mass frame of reference.
17. How is the mass and mean density of the earth related ?
18. Explain degrees of freedom of a system.
19. Give the postulates of a special theory of relativity.
20. Explain the concept of inertial frame of reference.
21. What is meant by length contraction ?

(9 × 1 = 9 w)

Section C

*Answer any five questions.
Each question carries 2 weightage.*

22. What is Galilean transformation ? Show that the distance between two points is invariant under Galilean transformation.
23. A body of mass 2kg which is initially at rest is dropped from a height of 3 metre onto a vertical spring having force constant 490N/M. Calculate the maximum distance through which the spring will be compressed.
24. State and explain D' Alembert's principle. Is D' Alembert's equation true for real or virtual displacement.
25. If the exhaust speed of a rocket weighing 6100kg is 320m/sec how much gas must be ejected per second to supply the thrust needed to overcome the weight of the rocket. If the rocket is to be given an upward acceleration of 19.6m/s^2 . What is the rate of ejection of the gas?
26. What is the time dilation ? A π meson has a mean life of $2 \times 10^{-8}\text{s}$. When measured at rest ? How far does it go before decaying into another particle if its speed is $0.98c$.
27. What is Galilean transformation ? Show that the distance between two points is invariant under Galilean transformation.
28. What is a Hamiltonian ? Obtain the canonical equations of Hamiltonian.

(5 × 2 = 10 weightage)

Section D

*Answer any two questions.
Each question carries 4 weightage.*

29. Describe the Michelson Morley experiment and account for the null result of the experiment.
30. What is centre of mass ? Show that :
 - (a) The total linear momentum of a system of particles about the centre of mass is zero.
 - (b) Acceleration of the centre of mass of a system of particles is only due to external forces.
31. State and derive Kepler's laws of planetary motion from Newton's law of gravitation.
32. Explain the working principle of a rocket. Derive the differential equation representing rate of gain of speed by a rocket. What is the advantage of a two stage rocket ?

(2 × 4 = 8 weightage)