

72364

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Name.....49

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(UG-CCSS)

Core Course—Physics/Applied Physics

PH 3B 05/AP 3B 05—MECHANICS

(2009–2012 Admissions)

Time : Three Hours

Maximum : 30 Weightage

Part A

Answer all questions.

Each carries a weightage of $\frac{1}{4}$.

1. Absolute rest is :
 - (a) Imaginary.
 - (b) Real.
 - (c) Complex.
 - (d) Sometimes real and sometimes imaginary.
2. The motion of a projectile as seen from another is :
 - (a) Circular motion.
 - (b) Elliptical.
 - (c) Parabolic.
 - (d) Straight line motion.
3. A force which is constant and uniform is always :
 - (a) Zero.
 - (b) Conservative.
 - (c) Non-conservative.
 - (d) Infinite.
4. The graph plotted between potential energy and distance has :
 - (a) Parabolic shape.
 - (b) Straight line.
 - (c) Elliptical shape.
 - (d) Hyperbolic shape.
5. The maximum height attained by a rocket is :
 - (a) R.
 - (b) 2R.
 - (c) 3R.
 - (d) 4.3R.
6. The shape of galaxy is :
 - (a) Spherical.
 - (b) Elliptical.
 - (c) Convex.
 - (d) Concave.
7. The angular momentum of a particle moving under the action of a central force is :
 - (a) $J = r \times p$.
 - (b) $lw = p$.
 - (c) Zero.
 - (d) $J = \frac{dv}{dt}$.

Turn over

8. When a particle moves under the action of a central force, its angular momentum is :
- (a) Not conserved. (b) Conserved.
(c) Zero. (d) Infinite.
9. The force on a point mass at the centre of a sphere of radius R is :
- (a) Proportional to R^2 . (b) Proportional to \sqrt{R} .
(c) Inversely proportional to R^2 . (d) Zero.
10. The null result of the Michelson Morley experiment :
- (a) Confirms the existence of ether.
(b) Confirms a privileged frame of reference.
(c) Discards the existence of ether.
(d) Confirms the necessity of a medium for emw propagation.
11. The source of solar energy is :
- (a) Fission of protons. (b) Fusion of hydrogen atoms.
(c) Fusion of neutrons. (d) None of the above.
12. Constraints which can be absorbed in generalized co-ordinates are known as :
- (a) Holonomic. (b) Non-holonomic.
(c) Lagrangian. (d) Hamiltonian.

(12 \times $\frac{1}{4}$ = 3 weight)

Part B

Answer all questions.
Each question carries 1 weightage.

13. What is Pseudo force ?
14. What is Coriolis acceleration ?
15. Define force constant.
16. What is a non-conservative force ? Give one example.
17. What is areal velocity ? Express it mathematically.
18. Explain how angular momentum is conserved using an example.
19. Why is it that atmosphere is not present at moon's surface ?
20. What is Virtual work ?
21. What is meant by time dilation ?

(9 \times 1 = 9 weight)

Part C

Answer any **five** questions.

Each question carries 2 weightage.

22. Prove that the plane of oscillation of Foucault's pendulum rotate $15^\circ \sin Q$ per hour where ϕ is the latitude of the place.
23. Prove that the work done around a closed path is zero for conservative forces.
24. The maximum and minimum distance of a Comet from the sun are 1.4×10^9 km. and 7.0×10^7 km. If the velocity closest to the sun is 6×10^4 m/s, what is its velocity when farthest ?
25. Calculate the earth's gravitational potential density of earth = 5500 kg./m.^3 and radius of the earth = 6400 km. $G = 6.67 \times 10^{-11}$ MKS units.
26. A rod of length 1 m. is moving along its length with a velocity of 0.8 C. Calculate the length as it appears to an observer (a) on the earth ; (b) moving with the rod itself.
27. A π meson has a mean life time of 2×10^{-8} s when measure at rest. How far does it go before decaying into another particle if its speed to 0.98 C.
28. What is Hamiltonian ? Obtain the canonical equations of Hamiltonian.

(5 × 2 = 10 weightage)

Part D

Answer any **two** questions.

Each question carries 4 weightage.

29. 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 ?
30. What are Kepler's law of planetary motion ? Derive the Newton's law of gravitation from Kepler's laws of planetary motion.
31. Derive the relationship $H = \sum_j q_j \frac{\partial L}{\partial q_j} - L$ from the properties of Lagrangian.

(2 × 4 = 8 weightage)