C 25124 **(Pages : 3)** **Name**

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MARCH 2012

(CCSS)

Complementary Physics

PH 2C 03—MECHANICS, RELATIVITY WAVES AND OSCILLATION

Time : Three Hours Maximum : 30 Weightage

Section A

Answer **all** *questions.*

1. The motion of a projectile as observed from a matter projectile is :

   (a) Parabolic. (b) Elliptical.

   (c) Straight line. (d) Circular.

2. **If** the linear momentum of a body is increased by 50 %, its KE will increase by :

   (a) 50 %. (b) 100 %.

   (c) 125 %. (d) 150 %.

3. The centre of mass of a body lies :

   (a) At geometric centre. (b) Always inside body.

   (c) Always outside body. (d) Within or outside body.

4. The operator $\frac{}{dx}$ operates on eigenfunction gives eigenvalue K, then corresponding eigenvector is .

   (a) Kx. (b) $\cos Kx$.

   (c) $\sin Kx$. (d) e^{x}.

5. Which of the following equations represent S.H.M. ?

   (a) A sin wt + B cos wt. (b) A sin wt + B cos 2 wt.

   (c) A sine wt. (d) $e^{\sin wt}$

6. A spring pendulum has period T. If the spring is broken into two halves. One that piece connected to same mass. The period of this pendulum will be :

   (a) T. (b) $\frac{T}{}$

   (c) (d) $\frac{T}{a}$.

Turn over

7. The equation for progressive wave is $Y = A \sin (100 \pi t - 0.02z)$. Then velocity of wave is :

(a) 500π. (b) 5000π.

(c) 50π. (d) 5π.

8. A frame of reference which is moving with constant velocity with respect to a frame at rest is

(a) Inertial. (b) Non-inertial.

(c) Rotating. (d) Absolute.

9. Rest mass of a body m_0, its dynamic mass when it is moving with a velocity equal to half the speed of light is

(a) $\frac{2m_0}{\sqrt{3}}$. (b) $\frac{m_0}{2}$.

(c) m_0 (d) $\frac{m_0}{2}$

10. Angular momentum of a body under central force field :

(a) Zero. (b) Constant.

(c) Increases. (d) Decreases.

11. A bullet of mass a and velocity b is fired into large block mass c. The final velocity of system is :

(a) $\frac{cb}{a+b}$. (b) $\frac{b}{c}(a+b)$.

(c) $\frac{ab}{a+c}$ (d) $\frac{a}{a}(a+c)$.

12. If speed of a body of rest mass m and length L in the direction of motion, is equal to speed of light. Then its relativistic mass and length are :

(a) m, L. (b) 0, 0.

(c) 0, infinity. (d) Infinity, 0.

(12 x ¼ = 3 weightage)

Section B

Answer all the questions.

13. Prove that force is negative gradient of potential.

14. What is meant by linear restoring force ?

15. Define stable, neutral and unstable equilibrium using potential energy curve.

16. What is meant by inertial frame-of reference ? Give example.

17. Explain energy function.

18. Under what condition Lorenz transformation reduces to Galilean transformation ?

[9. Show that curl of conservative forces vanishes.

20. Show that all the inertial frames in constant relative motion are equivalent.

21. Give the basic principle of S.T.M.

x 1 = 9 weightage)

Section C

Answer any **five** *questions.*

:2. Show that speed of rocket is twice the exhaust speed if $\frac{M_0}{M} = e^2$.

23. The mass of a particle is triple its rest mass. What is its speed ?

?,4. An eigenfunction of the operator $\frac{d^2}{dx^2}$ is $\psi = e^{-}$ Find the corresponding eigenvalue.

25. A particle of mass 0.1 kg. is in a field of potential $U = 5x^2 + 10$ J/kg. Find the frequency of oscillation.

26. Two particles of masses 2 kg. and 10 kg. with position vectors 3i + 2j + k and $i - j + k$ respectively. Find out the position vector of centre of mass.

27. Prove that gravitational force is conservative.

!8. The position vector of a particle of mass m under the influecne of force is $r = A \sin wt\, \hat{i} + B \cos wt\, j$. Find out expression for force.

(5 x 2 = 10 weightage)

Section D

Answer any **two** *questions.*

29. What are Fundamental postulates of special theory of relaivity ? Obtain Lorentz transformation equation.

30. What is meant by Wave function ? Develop Schrödinger's one-dimensional time dependent equation.

31. Give the basic principles of rocket propulsion. Hence derive an expression for final velocity of rocket.

(2 x 4 = 8 weightage)