STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.

(For candidates admitted during the academic year 2004-05 & thereafter)

B.Sc. DEGREE EXAMINATION APRIL 2009
BRANCH III - PHYSICS
FOURTH SEMESTER

REG. No._____

COURSE : **MAJOR – CORE**
PAPER : **MECHANICS**
TIME : **30 MINS.**   MAX. MARKS : 30

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

SECTION – A

ANSWER ALL QUESTIONS: (30 x 1 = 30)

I   CHOOSE THE CORRECT ANSWER:

1.   The resultant of two forces 5N and 10N can never be
     a) 4N   b) 6N   c) 3N   d) 10N

2.   A particle is simultaneously subjected to two equal velocities (4,4). If 'α' is the
     angle between the two equal velocities, then the resultant velocity is given by
     a) 2u Cos α   b) 2u Sin α   c) 2u cos α/2   d) 2u sin α/2

3.   A particle is projected horizontally from the top of a tower. Neglecting air
     resistance, its trajectory is a
     a) straight line   b) parabola   c) circle   d) ellipse

4.   The range of a projectile is equal to the maximum height reached by the particle.
     The angle of projection is
     a) 38°   b) 76°   c) 42°   d) 84°

5.   If 'T' is the time of flight and 't' is the time taken by the projectile to reach the
     highest point, then
     a) T = t   b) t = T/2   c) t = 2T   d) t = T/4

6.   The dimensions of impulse are the same as that of
     a) Force   b) Acceleration   c) Velocity   d) Momentum

7.   The M.I of a thin rod about an axis through its C.G perpendicular to its length is
     a) $\dfrac{ML^2}{3}$ b) $\dfrac{ML^2}{6}$ c) $\dfrac{ML^2}{9}$ d) $\dfrac{ML^2}{12}$

8. A solid sphere of radius 'r' rolls on a horizontal surface without slipping. Its total kinetic energy is given by

    a) $\dfrac{2}{5}MV^2$
    b) $\dfrac{ML^2}{6}$
    c) $\dfrac{ML^2}{9}$
    d) $\dfrac{ML^2}{12}$

9. The acceleration of a solid cylinder of radius 'r' rolling on an inclined plane of inclination 'α' to the horizontal is

    a) $\dfrac{2}{3}g\sin\alpha$
    b) $\dfrac{5}{7}g\sin\alpha$
    c) $\dfrac{1}{2}g\sin\alpha$
    d) $\dfrac{3}{4}g\sin\alpha$

10. The M.I of a solid sphere about a target is

    a) $\dfrac{7}{5}MR^2$
    b) $\dfrac{2}{5}MR^2$
    c) $\dfrac{5}{2}MR^2$
    d) $\dfrac{5}{7}MR^2$

11. The expression for the C.G of a hollow hemisphere is given by (radius – r)

    a) $\dfrac{3}{8}r$
    b) $\dfrac{3}{4}r$
    c) $\dfrac{r}{2}$
    d) $\dfrac{r}{4}$

12. The dimensions of Reynold's number is

    a) m/s
    b) m/s²
    c) (1/sec)
    d) none of these

13. The period of oscillation of a compound pendulum is a minimum when

    a) $K = \hbar/2$
    b) $K = 2\hbar$
    c) $K = \hbar$
    d) $K = 4\hbar$

14. The dimensional formula for Angular momentum is

    a) $ML\,T^{-2}$
    b) $ML^2\,T^{-1}$
    c) $ML^2\,T^{-2}$
    d) MT^{-3}

15. The period of revolution of a conical pendulum is given by

    a) $T = n\sqrt{\dfrac{h}{g}}$
    b) $T = 2\Pi\sqrt{\dfrac{g}{h}}$
    c) $T = 2\Pi\sqrt{\dfrac{h}{g}}$
    d) $T = \Pi\sqrt{\dfrac{g}{h}}$

II   STATE WHETHER TRUE OR FALSE:

16. At the highest point, the velocity of a projectile is ZERO.

17. The range of a projectile is a maximum when the angle of projection is 45°.

18. The centrifugal force is a pseudo force.

19. For streamline motion, the Reynold's number must be greater than 3000.

20. If 'L' is not an explicit function of time, 'H' is a constant of motion.

III FILL IN THE BLANKS:

21. In an elastic collision _____ is always conserved.

22. If the torque acting on a rigid body is ZERO, then _____ is a constant of motion.

23. Moment of Inertia is a _____ quantity.

24. The expression for maximum range on an inclined plane is _____.

25. A space of dimension 'h' is called a _____ space.

IV   ANSWER BRIEFLY:

26. State parallel axes theorem.

27. Define 'centre of gravity'.

28. Distinguish between 'streamline' and 'turbulent flow'.

29. Define 'Relative velocity'.

30. Define 'phase space'.

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SUBJECT CODE : **PH/MC/ME44**

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COURSE   :   **MAJOR – CORE**
PAPER   :   **MECHANICS**
TIME   :   **2 ½ HOURS**   MAX. MARKS : 70

SECTION – B

ANSWER ANY FIVE QUESTIONS: (5 x 5 = 25)

1.   A particle is simultaneously subjected to several velocities u_1, u_2, …u_0. Find the resultant in magnitude as well as direction.

2.   A cricket ball thrown from a height of 1.5m at an elevation of 30º with a speed of 30 m/s is caught by another cricketer at a height of 0.5m above the ground. How far apart are the two men?

3.   Two billiard balls of equal mass are in contact on a smooth horizontal table. A third ball of equal mass strikes them simultaneously and remains at rest. Find the coefficient of restitution.

4.   A thin uniform bar of length 1.2m oscillates about an axis passing through one end perpendicular to its length. Find the period of oscillation.

5.   Deduce an expression for the C.G of a solid cone.

6.   Deduce Euler's equation of continuity of flow.

7.   Solve the problem of Atwood's machine using Lagrange's equations.

SECTION – C

ANSWER ANY THREE QUESTIONS: (3 x 15 = 45)

8.   a) Derive an expression for the range of a projectile on an inclined plane.

        b) Deduce an expression for the loss of Kinetic energy due to direct impact of two spheres.

9.   Deduce an expression for the moment of inertia of
        a) a solid sphere about a diameter

        b) a solid cylinder about an axis through the C.G perpendicular to its length.

10. a) Deduce an expression for the period oscillation of a Bifilar pendulum (parallel threads).

    b) Describe an experiment to determine the value of 'g' at a given place using compound pendulum.

11. Deduce an expression for the centre of gravity of (i) a solid Tetrahedron and (ii) a hollow hemisphere.

12. Derive Lagrange's equations of motion for a conservative system.

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