STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-2012)

SUBJECT CODE : 11PH/MC/ME24

B.Sc. DEGREE EXAMINATION APRIL 2012
BRANCH III - PHYSICS
SECOND SEMESTER

REG. No._____

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

SECTION – A
TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS: **(30 x 1 = 30)**

I CHOOSE THE CORRECT ANSWER:

1. The coefficient of restitution is equal to one, the loss K.E. is
   a) maximum b) zero c) minimum d) infinity

2. Two bodies are said to impinge……if the direction of motion of either or both is not along the common normal at the point of contact
   a) directly b) normally c) obliquely d) relatively

3. The constraints involved when particle is restricted to move along a curve or surface area
   a) seleronomic b) rheonomic c) holonomic d) non-holonomic

4. The equation of simple harmonic motion is
   A = -wx b) $a = -\frac{w^2}{x}$ c) a = $-w^2x^2$ d) a = $-w^2x$

5. A body continues to oscillate with a constant amplitude and its own natural frequency, such vibrations of a body are called
   a) free vibrations b) forced vibrations c) damped vibrations
   d) light damping

6. When displacement is zero the K.E. of a harmonic oscillator is
   a) maximum b) minimum c) zero d) infinity

7. The phase of a forced vibration is

   a) $\tan\theta = \frac{2rP}{w^2 - P^2}$ b) $\tan\theta = \frac{rP}{w^2 - P^2}$

   c) $\tan\theta = \frac{2r^2P^2}{w - P}$ d) $\tan\theta = \frac{2r^2P^2}{w^2 - P^2}$

..2..

8. The moment of inertia does not depend on
   a) mass of the body
   b) the axis of rotation of the body
   c) the distribution of mass in the body
   d) the angular velocity of the body

9. The Precessional angular velocity varies inversely on the magnitude of
   a) linear momentum b) angular momentum
   c) toque d) mass

10. The moment of inertia of a thin circular ring about a tangent is
    a) $\frac{1}{2}MR^2$ b) $\frac{2}{3}MR^2$ c) $\frac{3}{2}MR^2$ d) $\frac{3}{2}M^2R$

11. The C.G. of a solid hemisphere is on its axis at a distance____ from the centre
    a) $\frac{3}{4}r$ b) $\frac{3}{6}r$ c) $\frac{3}{8}r$ d) $\frac{8}{3}r$

12. The distance of C.G. of the cone from the vertex is given by
    a) $\frac{3}{4}h$ b) $\frac{4}{3}h$ c) $\frac{2}{3}h$ d) $\frac{3}{2}h$

13. The expression for centre of gravity of the remainder G_1 is
    a) $\frac{W_2}{(W-W_1)}G_2$ b) $\frac{W_2}{(W_2-W_1)}G$
    c) $\frac{W_1}{(W-W_1)}G_2$ d) $\frac{W_2}{(W-W_2)}G_2$

14. If the constraints are independent of……they are called Scleronomic
    a) time b) mass c) velocity d) direction

15. For a particle constrained to move on a plane only two variables x, y (or) r, θ are sufficient to describe its motion and the particle is said to have……..degrees of freedom.
    a) One b) two c) three d) four

II FILL IN THE BLANKS:

16. The K.E. is conserved the collision is said to be……

17. The coefficient of inertia in rotational motion is called the……of the body about the given axis.

18. A body be imagined to be taken to the centre of the earth, the force of gravity will be……

19. The mathematical statement of D'Alemberts Principle is……..

20. Relation between the linear velocity and angular velocity is……..

III STATE WHETHER TRUE OR FALSE:

21. If e = 1, the bodies are called perfectly plastic bodies.
22. A system executing SHM is called harmonic oscillator.
23. The time period of a compound pendulum is minimum when its length is zero.
24. Centre of mass is independent of gravity and is an inherent property of matter.
25. Constraints are restrictions imposed on the position or motion of the system because of geometrical conditions.

IV ANSWER BRIEFLY:

26. Define coefficient of restitution.

27. Define SHM.

28. State perpendicular axes theorem.

29. Define centre of gravity.

30. Explain degrees of freedom.

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PAPER : MECHANICS
TIME : 2 ½ HOURS **MAX. MARKS : 70**

SECTION – B

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

1. A ball of mass 8 kg, moving with a velocity of 10 ms^{-1} impinges directly on another mass 24 kg. moving at $2ms^{-1}$ in the opposite direction. If e = 0.5 find the velocities of both after impact.
2. A smooth sphere of mass 4 kg. moving with a velocity of 8 ms^{-1} impinges directly on a smooth sphere of mass 5 kg. moving in the same direction with the velocity of 4 ms^{-1}. Find the velocities of the spheres after impact. (e=0.5)
3. Derive an equation for damp----ed harmonic oscillator.
4. A circular disc of mass 100 g and radius 10 cm is making 2 revolutions per sec about an axis passing through its centre and perpendicular to its plane. Calculate its Kinetic energy.
5. A solid sphere of mass 50 g and diameter 2 cm rolls without sliding with a uniform velocity of 5 m/s along a straight line on a smooth horizontal table. Calculate its K.E.
6. A solid cone and a solid hemisphere of the same material have a common base. Find the ratio of the height of the cone to the radius of the hemisphere of the C.G. of the combination coincides with the centre of the common base.
7. Explain the term virtual displacement and derive an equation for principle of virtual work.

SECTION – C

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

8. A smooth sphere of mass m_1 moving with velocity u_1 impinges obliquely on a smooth sphere of mass m_2 moving with velocity u_2. If the directions of motion before impact make angles α and β with the common normal. Find the velocities and directions of the spheres after impact. Also find an expression for loss of K.E. due to oblique impact.

9. Explain the variation of Kinetic and potential energies of a simple harmonic oscillator. Illustrate your answer with suitable graph.

10. Obtain an expression for the time-period of a compound pendulum. Also find the value of g.

11. Find the position of C.G. in the following cases
(i) Solid cone (ii) solid tetrohedran

12. Derive Lagrangian equation of motion from D'Alemberts principle for a holonomic conservative system.