STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2008-09 & thereafter)

SUBJECT CODE : PH/MC/ME44

B.Sc. DEGREE EXAMINATION APRIL 2011
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. With usual symbols, the centripetal force can be expressed as
   a) mw^2r b) mw^2 c) mwr d) mw^2/r

2. Perfectly elastic collision has restitution
   a) e = 0 b) e = 1 c) e > 1 d) e < 1

3. For a SHM , the acceleration is proportional to
   a) displacement y b) y^2 c) -y d) $-y^2$

4. The displacement y = a for phase 0 to π and y = 0 for π to 2π. This represents a
   a) circle b) line c) square wave d) sine wave

5. Two masses m_1 and m_2 are separated by a distance, the reduced mass of the system will be
   a) $\frac{m_1 m_2}{m_{1+} m_2}$ b) $m_{1+} m_2$ c) $m_{1-} m_2$ d) $m_1 m_2$

6. The moment of inertia of a uniform rod of length L and mass M about an axis perpendicular
   to length and passing through one end will be
   a) ML^2 b) $\frac{ML^2}{2}$ c) $\frac{ML^2}{3}$ d) $\frac{ML^2}{12}$

7. The moment of inertia of a ring about its diameter will be
   a) MR^2 b) $\frac{MR^2}{2}$ c) $\frac{MR^2}{4}$ d) $\frac{MR^2}{8}$

..2..

8. Moment of inertia of a solid cylinder about its symmetry axis will be
   a) $\frac{ML^2}{3}$ b) $\frac{ML^2}{12}$ c) $\frac{MR^2}{2}$ d) MR^2

9. The period of oscillation of a bifilar pendulum is proportional to
   a) its moment of inertia I b) I^2 c) I^3 d) $\sqrt{I}$

10. The centre of gravity of a tetrahedron lies at a depth d from the vertex where *d* is
    a) $\frac{3h}{4}$ b) $\frac{h}{4}$ c) $\frac{h}{2}$ d) $\frac{2h}{3}$

11. At critical velocity of a liquid, Reynold's number is
    a) k> 1000 b) k< 1000 c) k = 1 d) k = 1000

12. A force F acting for a time t will have an impulse
    a) Ft b) F/t c) F^2t d) t/F

13. The unit of moment of inertia is
    a) Kg/m b) Kg – m c) Kg – m^2 d) Kg

14. For an elastic collision of 2 spheres, the velocity of approach of the spheres V_a and velocity of separation V_s are related as
    a) $V_a < V_s$ b) $V_a > V_s$ c) $V_s = 0$ d) $V_a = V_s$

15. A body of mass M and moment of inertia I has radius of gyration K equal to
    a) $\sqrt{\frac{I}{M}}$ b) $\frac{I}{M}$ c) $\frac{M}{I}$ d) $\sqrt{\frac{M}{I}}$

Fill in the blanks:

16. Coefficient of restitution is defined as ----------

17. A saw tooth wave can be mathematically represented as ----------

18. Centre of mass of a system of particles can be represented as ----------

19. Euler's equation of continuity is ----------

20. D'Alembert's principle can be stated as ----------

State whether TRUE or FALSE:

21. Oblique impact is a two dimensional impact.

22. The centres of suspension and oscillation are interchangeable.

23. Streamlined flow is possible only when the velocity of the liquid is above the critical velocity.

24. Critical velocity is large for highly viscous liquid.

25. Two colliding bodies will exchange their velocities after an elastic collision.

Answer briefly:

26. What is centrifugal force?

27. What are forced oscillations?

28. Explain periodic motion

29. State Fourier's theorem

30. What is gyroscope?

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SECTION – B

Answer any FIVE of the following: **(5 x 5 = 25)**

1. A sphere of mass 1kg moving 1 m/s collides with another of mass 2kg at rest. If the collision is inelastic, calculate the loss in kinetic energy.
2. A stone tied to a string of length 1m executes circular motion as a conical pendulum. If the string subtends an angle 20^o to the vertical, calculate the period of oscillation.
3. A stone of mass 1g executes SHM with angular velocity 3 rad/sec and amplitude 1cm. Calculate the energy of oscillation.
4. A circular disc of mass 1 kg and radius 10 cm rotates about an axis passing through the centre and perpendicular to the plane of the disc. Calculate the moment of inertia.
5. Calculate the moment of inertia of a spherical shell of mass 1 kg and radius 1m about its tangent.
6. Obtain the expression for centre of gravity of a solid cone.
7. Explain the principle of Atwood's machine.

SECTION – C

Answer any THREE of the following: **(3 x 15 = 45)**

8. For direct impact of two spheres, obtain expressions for the final velocities of the two spheres.
9. Explain free, damped and forced vibrations and the condition for resonance
10. Derive the expression for moment of inertia of a solid sphere about its diameter
11. Obtain expressions for centres of gravity of solid and hollow hemispheres.
12. Obtain Lagrange's equation and explain its application to a simple pendulum.

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