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

SUBJECT CODE : 11PH/MC/ME24

B.Sc. DEGREE EXAMINATION APRIL 2014
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 THE QUESTIONS: **(30 × 1 = 30)**

I CHOOSE THE RIGHT ANSWER:

1. The product (F x t) of the force (F) acting on a body for a short time is called
   (a) Impact (b) momentum (c) impulse (d) none

2. The characteristics of SHM is
   (a) Periodic (b) acceleration proportional to displacement
   (c) St.line motion about the mean position (d) all the above

3. If the difference between the natural frequency of a vibrating body and the applied force is small, the amplitude is
   (a) Large (b) small (c) zero (d) one

4. Pendulum beats a second , time taken for a swing is
   (a) 1s (b) 2s (c) 0.5s (d) 4s

5. Which of the following is a correct expression for centripetal force
   (a) Mv^2/r^2 (b) Mv^2/r (c) Mvr (d) Mr^2/v

6. To keep the body in a stable equilibrium the bottom of the body should be made
   (a) very large (b) very heavy (c) very rigid d) very near to the ground

7. In SHM the acceleration of the particle is zero when the velocity is
   (a) Maximum (b) half its max. (c) zero (d) none of the above

8. If the equation of a SHM is $Y=\sin(4\pi t+\varphi)$ its frequency is
   (a) 2 (b) ½ (c) 2π (d) $1/2\pi$

9. In a resonance tube, the 1st resonance occurs at 16cm and the 2nd resonance occurs at 49 cm. The end correction will be
   (a) 0.5cm (b) 0.3cm (c) 0.8cm (d) 0.2cm

10. The M.I. of a solid sphere about its diameter is $360 kgm^2$. If its mass is 0.01kg, the M.I. of the sphere about its tangent (in kgm^2).
    (a) 900 (b) 1260 (c) 360 (d) 720

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11. The linear momentum of a system of particle of mass(m) and velocity (v) is defined as p=
(a) m/v (b) mv (c) 1/mv (d) v/m

12. Which physical quantity is measured in joules/second?
(a) Acceleration (b) momentum (c) work (d) Power

13. The centre of gravity of a hollow hemisphere is
(a) 3r/8 (b) 3/8r (c) 1r/3 (d) r/2

14. The constraints involved in the motion of the point mass of a simple pendulum are
(a) Holonomic (b) non-holonomic (c) seleronomic (d) rheonomic

15. For a motion of system of n-particles with constraints expressed by $'l'$ equation, the required space is
(a) $3n$ (b) (3n + l) (c) $(l - 3n)$ (d) $(3n - l)$

II. STATE WHETHER TRUE OR FLASE:

16. There is no loss of energy in an inelastic collision
17. The centre of suspension and centre of oscillation can be interchanged in a compound pendulum.
18. The point at which the entire weight of the the object concentrated is called centre of gravity.
19. Lagrangian is defined as sum of potential and kinetic energy.
20. The potential energy of an harmonic oscillator is ½ mω^2.

III. FILL IN THE BLANKS:

21. In an impact the direction of common normal at the point of contact is called_____.
22. The C.G. of a solid tetrahedron _____.
23. The phenomenon _____ proves that sound waves can be reflected.
24. A rigid body of any shape and size, capable of oscillating freely about its axis passing through it is called_____
25. The limitations on the motion of system of particles are known as_____.

IV. ANSWER BRIEFLY:

26. What is Newton's experimental law?

27. State Fourier theorem.

28. Define moment of inertia.

29. Define centre of suspension and centre oscillation.

30. What is principle of virtual work?

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TIME : 2 ½ HOURS **Max. Marks : 70**

SECTION B

ANSWER ANY FIVE QUESTIONS: **(5 × 5 = 25)**

1. Two smooth spheres impinges directly. Calculate their velocity after the impact.

2. The mass of the bob of a conical pendulum is 0.5 kg and length of the string is 1.5m. The string is found to break when the pendulum makes 80 revolutions per minute. Find the maximum tension the string can bear.

3. Derive the expression for the moment inertia of a solid sphere.

4. A solid cone and a solid hemisphere of the some material have a common base. Find the ratio of the height of the cone to the radius of the hemisphere if the C.G of the combination coincides with the centre of common base.

5. A solid cylinder of radius 20 cm and mass 1.5kg rolls down a plane without slipping the inclination of the plane to the horizontal being 1 in 10. Find the acceleration of the cylinder and total kinetic energy of the cylinder after 10 seconds.

6. If the displacement of a moving point at any time is given by $= acos\omega t + bsin\omega t$. Show that the motion is simple harmonic. If $a = 6cm, b = 8cm, \omega = 3$ find the period, maximum velocity and maximum acceleration.

7. A ball impinges directly on an exactly equal and similar ball 'B' lying on a smooth horizontal table. If 'e' is the coefficient of restitution, prove that after the impact the ratio of the velocity of ball B to that of A is (1+e) : (1-e)

SECTION – C

ANSWER ANY THREE QUESTIONS: **(3 × 15 = 45)**

8. (a) Define Impulse and Impact.
   (b) State the laws of impact.
   (c) Explain the oblique impact between two smooth spheres. Derive the expression for the loss of kinetic energy due to oblique impact between two smooth spheres.

9. (a) Derive the expression for moment of inertia of a rectangular lamina
   (b) Give the theory of compound pendulum.
   (c) Prove that in a compound pendulum the centre of suspension and centre of oscillation are reversible.

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10. Obtain the expression for centre of gravity of
    (a) Hollow hemisphere (b) solid tetrahedron

11. State and explain D'Alembert's principle and derive the Lagrangian's equation from it.

12. (a) Apply Fourier's theorem to analyse a saw-tooth wave into its harmonic components.
    (b) Discuss the application of Fourier theorem for the analysis of square wave.