STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2015-16 and thereafter)

SUBJECT CODE :15PH/MC/ME34

B.Sc. DEGREE EXAMINATION NOVEMBER 2019
BRANCH III - PHYSICS
THIRD SEMESTER

COURSE : MAJOR – CORE
PAPER : MECHANICS
TIME : 3 HOURS **MAX. MARKS :100**

SECTION – A

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

I. CHOOSE THE CORRECT ANSWER:

1. The unit of impulsive force is
   a) N b) Ns c) Ns^{-1}
2. In oblique impact between two bodies, the direction of motion of each is along
   a) common tangent b)inclined with common normal c) common normal
3. Collision between atomic particles are
   a) complete inelastic b)elastic c) inelastic
4. In damped vibration _____decreases with time
   a) frequency b) velocity c) amplitude
5. Epoch of a simple harmonic wave is
   a) initial velocity b) initial frequency c) initial phase
6. In simple harmonic motion acceleration is proportional to
   a) phase b) frequency c) displacement
7. During precession the axes of a spinning gyroscopic top describes a
   a) cone b) sphere c) ellipsoid
8. The MI of a uniform rod about the axes through its centre and perpendicular its length is
   a) $ml^2/12$ b) $ml^2/3$ c) $ml^2/2$
9. In a rigid body in rotational motion, the distance between two particles
   a) remains constant b) increases c) decreases
10. The _____ of the body is independent of gravity
    a) centre of gravity b) centre of mass c) moment of inertia
11. The centre of gravity of a body is a _____at which force of gravity acts.
    a) Line b) axis c) point
12. If the Lagrange function is independent of time, then _____of a system is constant.
    a) Potential energy b) kinetic energy c) total energy

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13. Atwood machine is a system that has _____degrees of freedom.

a) One b) two c) three

14. _____reduces number of equations of motion

a) co ordinate b) constraints c) degrees of freedom

15. _____ coordinates are free from constraints

a) space b) normal c) generalised

II. FILL IN THE BLANKS:

16. The impulsive force is a measure of change in _____.
17. The period of damped vibration is _____ than period of undamped vibration.
18. In rotational motion _____replaces mass in translation motion.
19. The total _____ of the body is supposed to act at the centre of gravity.
20. The Lagrangian function L = _____.

III. STATE WHETHER TRUE OR FALSE:

21. In plastic bodies, impact causes maximum loss in kinetic energy.
22. When body oscillates in a resisting medium, the only opposing force is restoring force.
23. In a compound pendulum, centre of suspension and the radius of gyration are interchangeable.
24. All bodies have centre of mass and centre of gravity.
25. Constraints are restriction for the motion of a body.

IV. ANSWER BRIEFLY:

26. Define coefficient of restitution.
27. What is free vibration?
28. Write the principle of gyroscope.
29. What is a tetrahedron?
30. What is meant by degrees of freedom?

SECTION – B

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

31. A ball of mass 6 kg moving with a velocity10 ms^{-2} impinges directly on another ball of mass 24 kg moving with velocity 2 ms^{-2}in the opposite direction. If the coefficient of restitution is 0.5, find the velocities of the balls after impact.
32. State the laws of impact.
33. Deduce the differential equation for a particle of mass m, executing harmonic oscillation in vacuum.

34. Find the moment of Inertia for a circular disc of mass 200 gm and radius 10 cm about axis perpendicular to its plane.
35. A body of mass 1kg has moment of inertia 0.9 x 10^{-3} kgm^2 about an axis OO'passing through its centre and perpendicular to the plane of the body. Find the moment of inertia of the body about an axis parallel to OO' and at a distance 3 cm from the centre.
36. Find the position of the centre of gravity of a solid cone from the vertex along its axes. The height of a cone is 2 m and the semi vertical angle is 15°.
37. Deduce the time period of oscillation of a simple pendulum by applying the Lagrange equation.

SECTION – C

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

38. Discuss the effect of oblique impact of two smooth spheres.
39. What are forced vibration and resonance? Write the theory of forced vibration.
40. Using bifilar pendulum with parallel threads, deduce moment of inertia about three perpendicular axes. Hence prove the perpendicular axes theorem.
41. Derive the expression for centre of gravity of a solid and hollow hemisphere.
42. Derive Lagrange's equation of motion from D'Alembert's principle.

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