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

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

B.Sc. DEGREE EXAMINATION APRIL 2010
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. Resonance occurs when the frequency of the external force is equal to the _____ of the oscillating body.

   a. Natural frequency b. angular frequency c. linear frequency d. critical frequency

2. Impulse of force is equal to

   a. I = F. t, b. I = F/t, c. I = mv, d. I = mu

3. The dimensions of MI of a circular metal disc is

   a. ML^4 b. ML^3 c. ML^2 d. ML

4. The unit of Impulse is

   a. N/s b. Ns/m^2 c. Nm^2 d. Ns

5. The MI of a solid hemisphere is

   a. $2/3\ MR^2$ b. $2/5\ MR^2$ c. MR^2 d. $2/7\ MR^2$

6. The CG of a solid hemisphere whose radius is 24 cm is at a distance of _____ cm from the center of hemisphere

   a. 10 b. 9 c. 6 d. 3

7. If 2 smooth spheres A and B are moving with velocities u and v in the same direction then the relative velocity of B with respect to A is _____

   a. u + v b. u – v c. v – u d. None

8. The angular momentum is given by _____

   a. m.v b. I.v c. I. ω d. M. ω

..2..

9. The unit of critical velocity is _____

a. Ns b. N/s c. L/T d. LT

10. If the two spheres are perfectly plastic, the coefficient of restitution is _____

a. 0 b. 1 c.0. 5 d. none

11. In a time independent conservative system, the T. E is _____

a. T + V b. L c. T – V d. none

12. If the spheres are perfectly elastic the loss in K.E due to their impact is _____

a. maximum b. zero c. constant d. none

13. The flow of liquid above the critical velocity is _____

a. stream line flow b. turbulent flow c. radial flow d. none

14. In a compound pendulum when the point of suspension passes through the CG of the pendulum, the period is _____

a. maximum b. minimum c. constant d. none

15. Expression for critical velocity is _____

a. kr /ρη b. kη / ρr c. ρη / kr d. k/ ρηr

Fill in the blanks:

16. In a projectile motion, at the highest point the velocity is _____.

17. The mathematical statement of D'Alembert's principle is _____.

18. In a compound pendulum the period of oscillation is minimum when _____.

19. Kinetic theory of gases has been developed from the study of _____ in gases.

20. In direct collision the horizontal line joining the centres of two smooth spheres is called _____.

State whether TRUE or FALSE:

21. The impulse of a force is equal to the change in momentum produced.

22. A body is said to be stable or unstable or neutral based on the position of its CG.

23. A body may not have CM but has CG always.

24. If the Lagrangian function does not contain the time explicitly, the TE of the conservative system is conserved.

25. Constraints restrict the motion of the system.

Answer briefly:

26. State Newton's experimental law.

27. Distinguish between centripetal force and centrifugal force.

28. What is reduced mass?

29. Distinguish between CM and CG of a solid body.

30. What are constraints?

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SECTION – B

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

Answer any FIVE of the following

1. If an oblique collision occurs between two smooth perfectly elastic spheres one of which is initially at rest. Show that their paths after impact are at right angles to one another.
2. A curve of radius 30 cm is to be banked so that a car may make the turn at a speed of 46.8 Km/hr without depending on friction. What must be the slope of the curve ie the banking angle is θ.
3. Solve the problem of Atwood's machine using Lagrangian equation.
4. Derive the expression for the C.G of a solid tetrahedron.
5. A ball of mass 8 kg moving with a velocity of 10 m/s impinges directly on another mass 24kg moving at 2 m/s in opposite directions. If e = 0.5, find the velocities after impact.
6. Find the M.I. of a square lamina of mass 20 kg about an axis passing through its C.G. perpendicular to its plane of length 12 m.
7. A small object of mass 20 kg is rotating in a circle of diameter 0.2 m at the rate of 2000 revl./min. Find the rotational K.E. of the object.

SECTION – C

Answer any THREE of the following (3X 15 = 45)

8. a. Define critical velocity of a liquid flow.

   b. Obtain the equation of continuity for a stream line flow of a liquid.

   c. Derive Euler's equation of flow for liquids.

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9. Derive the Lagrangian equation of motion and its application to a simple pendulum.

10. Explain in detail free, damped and forced oscillations.

11. a. State the laws of impact.

b. Derive expressions for the velocities of two smooth spheres after direct impact.

c. Find the loss of K.E. in direct impact.

12. a. Obtain an expression for the time period of a compound pendulum.

b. What is the length of an equivalent simple pendulum.

c. How will you determine ‘g’ using compound pendulum experimentally.

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