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 2012
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. The value of e for perfectly elastic collision is

(a) e=0 (b) e = -1 (c) e=0.5 (d) e = +1

2. Which of the following is an example for perfectly elastic collision?

(a) Collision between two metal spheres

(b) Collision between a bullet and target

(c) Collision between atomic particles

(d) None of the above

3. In the case of simple harmonic motion

(a) Acceleration is inversely proportional to the amplitude but directed opposite to it.

(b) Acceleration is directly proportional to the amplitude but directed opposite to it.

(c) Acceleration is directly proportional to the amplitude but directed towards to it.

(d) Acceleration is inversely proportional to the amplitude but directed towards to it.

4. The moment of inertia of a uniform disc of mass M and radius R rotating about a tangent is

(a) $MR^2/2$ (b) MR^2 (c) $MR^2/4$ (d) $3/2(MR^2)$

..2..

5. The relation between L,T and g in a compound pendulum is

(a) $g = 4\pi^2 (L^2/T^2)$ (b) $g = 4\pi^2 (L/T^2)$ (c) $g = 4\pi^2\sqrt{}(L/T^2)$ (d) $g = 4\pi (L/T^2)$

6. The unit of force constant is

(a) no unit (b) Nm (c) N/m (d) Nm^{-2}

7. The relation between the acceleration of an object rolling in an inclined plane and the ratio K^2/R^2 of the system is

(a) $a\alpha\ K^2/R^2$ (b) $a\alpha\ (1+K^2/R^2)$ (c) $a\alpha\ 1/(1+K^2/R^2)$ (d) None of the above

8. The apparatus used for the smooth and less jerky motion of shaft in engines is

(a) hodograph (b) Flywheel (c)Compound pendulum (d) None of the above

9. Newton's experimental law states that

(a) F α a (b) linear momentum is conserved in elastic collisions

(c) e=1 for elastic collisions (d) None of the above

10. The dimension of impulse is equal to that of

(a) Force (b) Linear momentum (c) Velocity (d) Pressure

11. The Lagrangian function 'L' is defined as

(a) T-V (b) T/V (c)T + V (d) $\frac{d}{dt}(T-V)$

12. A Bead rolling on a surface of a sphere without slipping is an example of

(a) Holonomic and Rheonomic constraints

(b) Non-Holonomic and Rheonomic constraints

(c)Holonomic and Sceleronomic constraints

(d) Non-Holonomic and Sceleronomic constraints

13. Principle of virtual work states that

(a) $\sum_i F_i^a \,.\, \delta r_i = 1$ (b) $\sum_i F_i^a \,.\, \delta r_i = 0$ (c)$\sum_i F_i^a \,.\, \delta r_i \geq 1$ (d) $\sum_i F_i^a \,.\, \delta r_i \geq 0$

14. The centre of gravity of a solid hemisphere of radius 'r' is

(a) $\frac{3}{2}\ r$ (b) $\frac{3}{4}\ r$ (c) $\frac{3}{8}\ r$ (d) $\frac{1}{2}\ r$

15. The expression for critical velocity of fluid flow is

(a) $R\eta/\rho D$ (b) $R\eta/2\rho D$ (c) $\frac{3}{2}R\eta/\rho D$ (d) $\frac{5}{2}R\eta/\rho D$

II. FILL IN THE BLANKS:

16. If e = 0 the bodies are said to be perfectly _____

17. In a _____ system the total sum of the kinetic and potential energies of the system remain constant

18. In a compound pendulum the equivalent length of simple pendulum is _____

19. The centre of gravity of a right solid cone is along its axis at a distance of _____ from the vertex.

20. The Atwood's machine is a system with _____ constraint.

III. STATE TRUE OR FALSE

21. In an head on collision between two particles, the transfer of energy is maximum when their mass ratio is unity.

22. In a compound pendulum the centres of suspension and axis of rotation can be interchanged.

23. All periodic motions are Harmonic motions

24. A body may not have a centre of gravity but it has a centre of mass

25. The number of degrees for a system with N number of particles moving independently in free space is 'N'.

IV. ANSWER BRIEFLY

26. What is meant by coefficient of restitution?

27. Give example of free and damped oscillations.

28. Define the terms : centre of mass and reduced mass.

29. Define Critical velocity of fluid flow.

30. State the principle of virtual work.

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SECTION – B

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

1. Two spheres are identical in mass and volume, but one is hollow and other solid. Discuss the experimental method to identify them.

2. A thin uniform circular disc of 10kg and radius 10cm rotates about an axis and passing through its centre and perpendicular to its plane. Calculate its moment of inertia and radius of gyration.

3. At what angle must a railway track with a bend of radius 0.88km be banked for the safe running of train at a speed of 44m/s.

4. With example explain the types of constraints.

5. If the amplitude of a seconds pendulum, with a bob of mass 200gm, is reduced to half of its undamped values in 200s, what is the quality factor Q?(take $\log_e 10 = 2.30$)

6. What is the frequency of a simple pendulum 200cm long? And what is its frequency in free fall?

7. Derive the expression for CG of a solid cone.

SECTION – C

Answer any THREE of the following: **(3x15 =45)**

8. Derive the expression for loss of kinetic Energy due to oblique impact between two smooth spheres and discuss the special cases of elastic and inelastic collision.

9. Deduce the differential equation of a damped harmonic oscillator and discuss in detail the cases of critical and underdamping.

10. What is a compound pendulum? Explain the experimental method to determine 'g' using the compound pendulum.

11. Define Reynolds number. Also derive the Euler's equation of continuity of liquid flow

12. Derive Lagrange's equation of motion from D 'Alembert's principle for a holonomic conservative system.

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