

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2004-05 & thereafter)

SUBJECT CODE : PH/MC/ME44

B.Sc. DEGREE EXAMINATION APRIL 2008
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

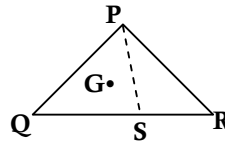
ANSWER ALL QUESTIONS:

(30 x 1 = 30)

I CHOOSE THE CORRECT ANSWER:

- A ball is thrown vertically upward with a speed of 20 m/s. What is its acceleration one second after leaving the thrower's hands?
a) zero b) $5 \frac{m}{s^2} \uparrow$ c) $5 \frac{m}{s^2} \downarrow$ d) $10 \frac{m}{s^2} \uparrow$
- If the two spheres are perfectly plastic, the coefficient of restitution is equal to
a) 0 b) 1
c) 0.5 d) None of the above
- If a body remains in equilibrium even in the displaced position, the equilibrium is said to be
a) stable b) unstable
c) neutral d) None of the above
- The walls of the gas vessel constitute a constraint is called
a) holonomic b) non-holonomic c) Rheonomic d) Sceleronomic
- The generalized momentum conjugate to a cyclic coordinate is
a) conserved b) zero
c) is not constant d) none of the above
- The unit of impulse of a force is
a) N/m^2 b) N/s c) Ns/m^2 d) Ns
- The relation between rotational K.E. and angular momentum of a body about the same axis is
a) $E = J^2/I$ b) $E = J^2/2I$ c) $E = J/2I$ d) $E = J^2/I^2$

8. The resultant of two equal forces is double of either of the forces, the angle between them is
 a) 60° b) 0° c) 90° d) 120°
9. A light and heavy body have equal K.E. Which one has a greater momentum
 a) light body b) heavy body
 c) both have equal momentum d) None
10. When body is revolving round a circle with a constant speed then,
 a) No force is acting on the body
 b) No acceleration is produced in the body
 c) Velocity of the revolving body remains the same
 d) No work is being done on the revolving body
11. When a body is subjected to a number of forces, the size of the body remains the same, the body is called
 a) Solid body b) Hard body c) Rigid body d) Rock-like body
12. To keep the body in stable equilibrium, the bottom of the body should be made
 a) very large b) very heavy
 c) very rigid d) very near the ground
13. What is the effect on the weight of the body if the speed of the earth increases
 a) Increases b) remains the same c) decreases d) No effect
14. PQR is a triangular lamina. Its C.G. divides the median PS such that the ratio of PG to GS is
 a) 1 : 3 b) 2 : 1
 c) 3 : 1 d) 1 : 1



II FILL IN THE BLANKS:

16. Kinetic theory of gases has been developed from the study _____ in gases.
17. The M.I. of a rod about the parallel axis through one end and perpendicular to the rod is _____.
18. A stone is whirled in a vertical circle. The tension in the string is greatest, when the stone is in the _____.
19. The displacement in a configuration system do not represent actual displacement of the system is called _____.

20. The common normal at the point of contact in a collision is called _____.

III STATE WHETHER TRUE OR FALSE:

21. The impulse of a force is equal to change in kinetic energy.

22. To make a body stable, it is often loaded with weights low down so as to lower the C.G. as much as possible.

23. The Moment of inertia plays the same role in rotational motion as mass does in translation motion.

24. Hamiltonian H, represents the total momentum of the system.

25. If a external torque acting on a system of particle is zero, the angular momentum of the system remains constant.

IV ANSWER BRIEFLY:

26. Define radius of gyration.

27. State the law of conservation of angular momentum.

28. Define critical velocity.

29. Explain : Constraints.

30. Explain : Centre of oscillation.



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SECTION – B

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

1. A stone is projected vertically upwards from a point on the ground with such a velocity that would carry it to a height of 19.6m. Two seconds later a second one is projected from the same point with the same velocity. When and where will the stones meet.
2. Define C.G. Find the position of C.G. in a solid tetrahedron.
3. Define Moment of inertia.
A diatomic molecule consists of two atoms of masses m & M kg and radius ' r ' is the distance between them. Calculate the moment of inertia of the system about an axis passing through the C.G of the system and perpendicular to the line joining the atoms.
4. Find the acceleration of Atwood's machine system by applying Lagrangian's equations of motion in generalized coordinates.
5. Define Impulse of a force.
A ball of mass ' m ' impinges obliquely on a ball of mass ' M ' at rest. If $m = eM$ P.T. the directions of motion of the balls are at right angles after impact.
6. A solid right cone has its base scooped out so that the hollow is a right cone on the same base. How much must be scooped out so that the C.G. of the remainder may coincide with the vertex of the latter.
7. A uniform rod 4m in length oscillates about a horizontal axis perpendicular to its length. Find the position of points about which the time period is minimum if $g = 980 \text{ cm/s}^2$. Find the minimum period of oscillation.

SECTION – C

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

8. a) State the laws of impact.
b) Obtain the velocities of two smooth spheres after direct impact.
c) Show that there is always loss of kinetic energy due to direct impact of two smooth spheres.

9. With relevant theory, describe Bifilar pendulum.
Using Bifilar pendulum, determine the value of 'g' and Moment of inertia about an axis passing through the center of gravity of the pendulum.
10.
 - a) Define Hamiltonian.
 - b) Explain the physical significance of the Hamiltonian function.
 - c) Using H, explain the motion of a particle in a central force field.
11.
 - a) Define stream-lined flow and turbulent flow.
 - b) What is Reynold's number?
 - c) Derive Euler's equation of flow for liquids.
12. Obtain the expression for Moment of Inertia of
 - a) Solid cylinder about its own axis and
 - b) Hollow sphere about its diameter.

