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 2007

BRANCH III - PHYSICS

FOURTH SEMESTER

COURSE : **MAJOR – CORE**

PAPER : **MECHANICS**

TIME : **2 ½ HOURS** MAX. MARKS : 70

SECTION - B

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

1. To a cyclist riding at the rate of 8 ms^{-1} due east the wind appears to blow from the north. When he doubles his speed, the wind appears to blow from the north east. Find the true velocity of the wind in magnitude and direction.

2. A cricket ball thrown from a height of 1.5m with a velocity of 30 m/s at an elevation of 30^o is caught by a fieldsman at a height of 0.5m above the ground. How far apart are the two men?

3. Deduce an expression for the period of revolution of a conical pendulum.

4. A motor cyclist is riding on a curved track of radius 500m. If the coefficient of friction between the tyres and the road is 0.5, what should be the maximum speed to avoid skidding? [g = 10 m/s^2].

5. A thin uniform bar of length 1.2m and breadth 0.12m is made to swing in a vertical plane about an axis through a point A, at a distance K from the C.G. Find the value of K if the period of oscillation is a minimum.

6. Derive an expression for the centre of gravity of a solid cone.

7. Solve the problem of Atwood's machine using Lagrange's equations.

SECTION - C

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

8. a) A particle has velocities u_1, u_2, …u_n in directions which are inclined at $\theta_1, \theta_2, ...\theta_n$ respectively with a given direction (X - axis). Find the resultant velocity in magnitude and direction.

9. Deduce an expression for the range of a projectile on an inclined plane. Deduce an expression for the loss of kinetic energy when two smooth spheres undergo head-on collision.

10. a) State and prove parallel axes theorem.

    b) Deduce an expression for the moment of inertia of a solid cylinder about an axis passing through its C.G. and perpendicular to its length.

11. a) Deduce an expression for the centre of gravity of a solid tetrahedron.

    b) Derive Euler's equation of continuity of flow.

12. a) Derive Hamilton canonical equations.

    b) Deduce the equations of motion for a particle moving under a central force field.