ISI Physics I - Alternate test
Maximum marks : 50

1. A particle moves around a semicircle of radius R, from one end A of a diameter to the other B. It is attracted towards its starting point A by a force proportional to its distance from A. When the particle is at B, the force towards A is F_0. Calculate the work done against this force when the particle moves around the semicircle from A to B.

2. A piece of string of length l which can support a maximum tension T, is used to whirl a particle of mass m in a constant gravitational field. What is the maximum speed with which the particle may be whirled if the circle is horizontal ? and vertical ?

3. A billiard ball sliding on a frictionles table strikes an identical stationary ball. The balls leave the collision at angles $\pm\theta$ with the original direction of motion. Some kinetic energy is taken up as the rotational energy by the balls. What is it as fraction of the initial kinetic energy. (There is no dissipation in friction.)

4. A man weighing 180 lb is climbing up a 12 ft ladder weighing 20 lb. The ladder rests on one end on a smooth vertical wall. the other end is on the horizontal floor and at a distance of 6 ft from the vertical wall. The floor can provide a maximum of 80 lb tangential frictional force. How far along the ladder can the man climb ?

5. A particle of mass $3m$ explodes into three equal pieces. two of the pieces fly off at right angles to each other, one with a speed $2v$ and the other with a speed $3v$. What is the magnitude and direction of the momentun of the third fragment ?

Distribution of marks : Q1- 8, Q2- 12, Q3- 10, Q4- 10, Q5- 10.