# Linear momentum and system of particles
## Assignment 2

**Question 1.**
A body A having mass $m_1$ travelling with velocity u makes an head on elastic collision with the stationary body B of mass $m_2$
a) Calculate the final velocities of A and B
b) Calculate the Final Kinetic energy of both the mass
c) Calculate the ratio of the kinetic energy transferred to $m_2$ to the original kinetic energy
d) For what value of $m_2$, all the energy is transferred to the stationary object
e) Calculate the velocity of the Center of mass before collision and after collision

**Question 2.**
An imperfectly elastic particle is projected from a point in horizontal plane with velocity u at any angle α to the horizon. If e is the coefficient of restitution
Let **i** and **j** are the unit vector across the x and y axis respectively
a) Find the velocity of particle after first rebound
b) Find the total time taken by the particle before stopping rebounding
c) Find the total range
d) Find the velocity at the $m^{th}$ rebound
e)Find the tangent of angle of projection at $m^{th}$ rebound
g) Find the height reached after $m^{th}$ rebound
f) Find the total impulse exerted by the surface on the ball

**Question: 3.**
10 objects of mass $m_0$,2 $m_0$,3 $m_0$…….10 $m_0$ are placed on the x axis at (L,0),(2L,0)……(10L,0).Find the center of mass of the system

**Question 4.**
A machine gun fires six bullets per sec into a target. The mass of each bullet is 4 g.The speeds is 600m/s.Find the average force required to hold the gun in position. What is the power delivered to the bullet?

**Question 5.**
A body of mass 3 kg moving with a velocity (**i** +2**j** +3**k**) m/s collides with another body of mass 4 kg moving with a velocity (2**i**+**j**+**k**) in m/s.They stick together .Find the velocity of the composite body.Find the Kinetic energy before collision and after collision

**Question 6.**
Cannon of Mass m starts sliding freely down a smooth inclined plane at an angle α to the horizontal. After the canon has reached $\mathbf{v_0}$ **,** a shot was fired .The shell leaves the canon in horizontal direction with a momentum $\mathbf{p_1}$**.** The cannon stop as consequences.
Assume the mass of the shell is negligible as compared to the canon
1. The change in momentum of the system

2. Calculate the duration of the shot

**Question 7.**
A flat car of mass $m_0$ starts moving to the right due to constant horizontal force F at t=0.Sand spills on the flat car from the stationary hopper .The velocity of loading is μ kg/sec.
a) Calculate the Initial acceleration of the flat car
b) Velocity and acceleration as a function of time
c) Momentum of the car at any instant
d) If the sand hopper moves with velocity $v_0$ in the left direction, what will be the velocity of the car at any instant?

**Question 8.**
A bullet of mass m is fired horizontally with a velocity v on a wooden block of mass M suspended from a support and gets embedded in it.
a) Calculate the final velocity of the composite block
b) Calculate the KE of the composite block
c) Find the height reached by the composite block