

- Q.1 A body is projected with velocity 'u' at an angle  $\theta$  to the vertical from an elevator moving upwards with velocity 'v'[at that instant] and acceleration 'a'. How will the motion of elevator affects its horizontal range, time of flight and maximum height? [2]
- Q.2 Mountain roads rarely go straight up, but wind up gradually. Why? [1]
- Q.3 What happens when a massive sphere collides head on with light sphere? [2]
- Q.4 Why does a man receives no injury if jumps from a multi storied building into a stretched tarpaulin? [1]
- Q.5 The sum of magnitudes of two forces acting on a point is 18N and their resultant is 12N. If the resultant makes an angle of  $90^\circ$  with the force of smaller magnitude, what are the magnitudes of the two forces. [3]
- Q.6 Assume that for comfortable air travel, the horizontal acceleration should never be greater than  $10\text{m/s}^2$ . What is the shortest possible time to travel a distance of 280km? [3]
- Q.7 [a] If A, B and C are any vectors, then show mathematically that cross product is anti commutative  
[b] If A, B and C are any 3 vectors, find value of  $A \cdot [B \times C]$  [3]
- Q.8 Prove that work done by a constant force in displacing a body through certain distance measures that change in kinetic energy of the body. [3]
- Q.9 A body of mass M is at rest is struck by a moving body of mass m. Prove that the fraction of initial kinetic energy of mass m transferred to the struck body is  $4mM/[m+M]^2$  in an elastic collision. [3]
- Q.10 A body of mass is pulled on a rough horizontal surface with coefficient of friction  $\mu$ . At what angle with vertical should a string be pulled so that force required is minimum. Find the magnitude of minimum force. [3]
- Q.11 State Newton's second law of motion and prove that it is the real law of motion. [3]