1. Attempt the following: 
   a) Define the terms: Newton’s Second law of Motion, Moment of inertia
   b) Explain Parallel Axis theorem
   c) Explain the difference between Statics, Kinematics
   d) Explain the terms: Friction, coefficient of friction, angle of friction, angle of repose
   e) State the law of conservation of momentum

SECTION-A

2(a) Illustrate the following: 
   a) Coplanar Collinear force system
   b) Coplanar concurrent force system
   c) Coplanar parallel force system
   d) Coplanar non-concurrent force system

(b) State parallelogram law of forces. Derive the expression for finding resultant of the two forces acting at a point.

3(a) Explain dry friction in detail. What are the laws of dry friction?

(b) Establish equation for finding the effect and efficiency of the plane when a block of weight W lying on an inclined plane (inclination with horizontal being $\alpha$) is acted upon by a horizontal force. Consider a) upward motion and b) downward motion of the block.
4(a) What is a rigid truss? What are the assumptions for analysis of the truss? (8)
(b) By method of joint, find the forces in all members of the truss as shown in figure 1. (12)

SECTION-B

5. Find the Moment of Inertia of a lamina shown in figure about horizontal Centroidal axis and vertical axis. (20)

6(a) The velocity of a moving particle is given by the relation
\[ V = 15 - t + \frac{1}{24}t^3 \]
Where the velocity V is in m/s and time t is in seconds. Determine initial velocity and velocity after 3 seconds. Also determine the distance travelled in this time, average velocity and average acceleration. (10)
(b) An elevator with a weight of man 500kg starts moving upward at a constant acceleration and attain a velocity of 3m/s after travelling a distance of 3m, find: (i) Determine the tension in the cable (ii) if after attaining the velocity of 3 m/s the elevator stops in 2.5 seconds, find the pressure exerted by the lift on the lift to the man weighing 600N. (10)

7(a) Define and derive
i) the time of flight ii) the range of the projectile iii) the time of flight (10)
(b) The initial velocity of a projectile, fired from a cliff 100m high is, 150m/s. the angle of projection being 30° with the horizontal, find:
(i) The horizontal distance between the point of launch and the point where the projectile hits the ground. (ii) The maximum height achieved by the projectile. (10)