B. Tech.
(SEM. II) EXAMINATION, 2006-07
ENGINEERING MECHANICS

Time : 2 Hours] [Total Marks : 50

Note : (i) Attempt all questions.
(ii) Assume missing data suitably, if any.

1. Attempt any four of the following : 3.5\times4=14
   (a) Explain the law of transmissibility of forces.
   (b) A particle is acted by following forces.
       (1) 200 N inclined 30° with east towards north
       (2) 250 N towards the north
       (3) 300 N towards the north west
       (4) 350 N inclined at 40° with west towards south
       Find the resultant of all forces and its direction.
   (c) Four forces equal to P, 2P, 3P and 4P are acting along the four sides of a square ABCD as shown in figure. Find the magnitude, direction and position of resultant forces.

[Image of figure 1]

V-4035] 1 [Contd...
(d) A smooth circular cylinder of radius 2 m is lying in a triangular groove, one side of which makes 20° and other side makes 40° angle with the horizontal. Find the reaction at the surfaces of contact, if there is no friction and the cylinder weighs 2 kN.

![Fig. 2]

(e) Briefly explain the Varignon’s Principle.

(f) Draw the bending moment diagram of the cantilever beam shown in the figure.

![Fig. 3]

2 Attempt any four of the following : 3x4=12

(a) Differentiate between an imperfect truss, perfect truss and redundant truss.

(b) For the given truss find the forces in members BC, CD and BD.

![Fig. 4]
(c) Find the centroid of a uniform wire bent in form of a quadrant of the arc of a circle of radius R.
(d) State the parallel axis theorem.
(e) What is product of inertia? What will the product of inertia of a circular disc about its centroidal axis be?
(f) Find the second moment of area of the given L-section about the centroidal x-axis as shown in Fig. 5.

Fig. 5

3 Attempt any two of the following: 6×2=12

(a) The pitch of a single thread screw jack is 6 mm and its mean diameter is 60 mm. If the coefficient of friction is 0.1, determine the force required at the end of a 250 mm long lever from the axis of the screw to (i) raise a load of 48 kN (ii) lower the same load. Is the screw self locking?

(b) A belt is running over a pulley of diameter 1000 mm at 450 rpm. The angle of contact is 150° and the coefficient of friction is 0.35. If the maximum tension in the belt is limited to 1 kN, determine the power transmitted by it.

(c) A car weighing 4 kN is moving at a speed of 200 m/s. The resistance to the car is largely due to the air drag which is equal to 0.005 v^2. What distance will it travel before its speed is reduced to 100 m/s?
4 Attempt any **two** of the following: 6*2=12
(a) A cylinder of radius 80 mm rolls without slipping along a horizontal plane AB. Its center has a uniform velocity of 15 m/s. Find the velocities of points D and E on the rim of the cylinder.

![Diagram](image)

**Fig. 6**

(b) State the D'Alembert's principle. A lift has an upward acceleration of 2.5 m/s². What pressure will a man of weight 800 N exert on the floor of the lift? Determine the pressure by him if the acceleration of lift is 2.5 m/s² downwards. Assume \( g = 9.8 \text{ m/s}^2 \).

(c) With suitable examples explain the difference between conservative and non-conservative forces. An object weighing 100 N is pulled up by a 80 N force up an inclined smooth plane as shown in **Fig. 7**. Determine the velocity of the object after it has moved 4 m.

![Diagram](image)

**Fig. 7**