Printed Pages : 4   ME – 202

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4035   Roll No. ☐☐☐☐☐☐☐☐☐☐☐

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 :   3.5×4=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.
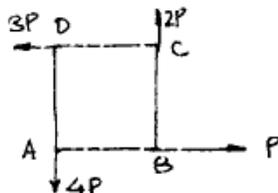

Fig. 1

(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.
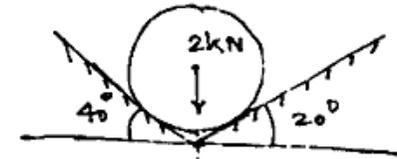

Fig. 2

(e)   Briefly explain the Varignon's Principle.

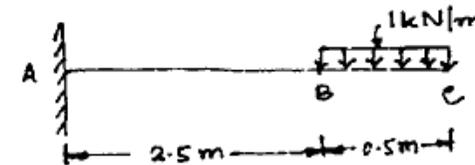(f)   Draw the bending moment diagram of the cantilever beam shown in the figure.

Fig. 3

2   Attempt any **four** of the following :   3×4=12

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

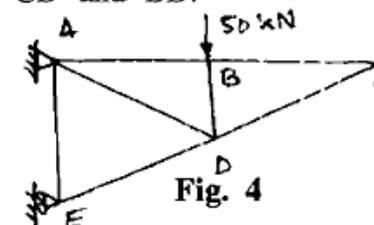   (b)   For the given truss find the forces in members BC, CD and BD.

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 ?

(f) Find the second moment of area of the given L-section about the centroidal x axis as shown in **Fig.5**
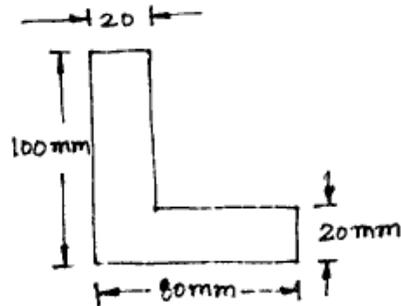

Fig. 5

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.
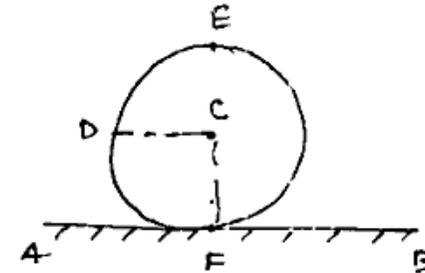

Fig. 6

(b) State the D'Alembert's principle. A lift has an upward acceleration of 2.5 m/s^2. 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/s^2 downwards. Assume g = 9.8 m/^{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.
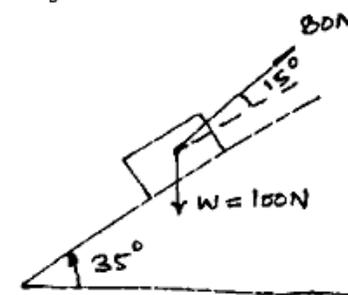

Fig. 7