01787

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2010

BME-016 : ENGINEERING MECHANICS

Time : 3 hours   *Maximum Marks : 70*

Note : *Answer* ***any five*** *questions. Use of calculator is permitted.*

1. (a) The resultant of the two forces, when they act at an angle of 60° is 14 N. If the same forces are acting at right angles, their resultant is $\sqrt{136}$ N. Determine the magnitude of the two forces.   7

(b) The resultant of four forces which are acting at a point 'O' as shown in Figure 1, along Y-axis. The magnitude of forces F_1, F_3 and F_4 are 10 kN, 20 kN and 40 kN respectively. The angles made by 10 kN, 20 kN and 40 kN with X-axis are 30°, 90°, and 120° respectively. Find the magnitude and direction of force. F2 if resultant is 72 kN.
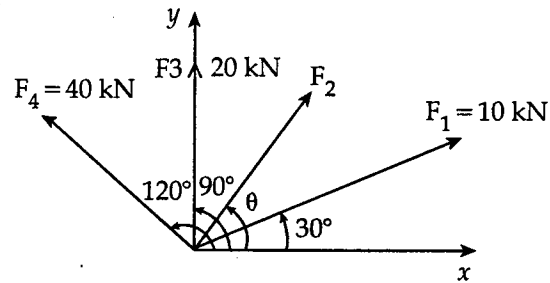
7

Figure - 1

2. (a) A wooden block rests on a horizontal plane. Determine the force required to (a) pull it (b) Push it. Assume the mass 'm' of the block to be 5 kg and the coefficient of friction $\mu = 0.4$.

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(b) In a First system of pulleys, there are 4 movable pulleys. If an effort of 100 N lifts a load of 1360 N, Find :

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(i) the effort wasted in friction.

(ii) the load wasted in friction.

3. (a) A truss is loaded as shown in figure below. **7**
Determine the axial forces in the members
CE, CG and FG.
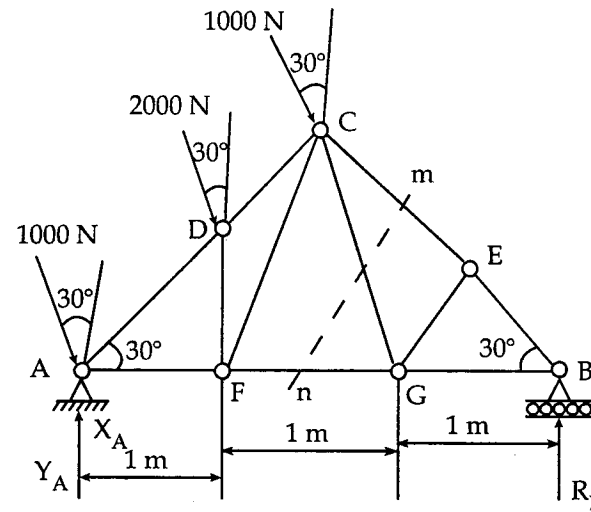
Figure

(b) A solid body is formed by joining the base **7**
of a right circular cone of height 'H' to the
equal base of right circular cylinder of
height 'h'. Calculate the distance of the
centre of mass of solid from its plane face,
when H = 12 cm and h = 3 cm.

4. (a) The cross-section of a beam is as shown in   7
figure below.

Semicircle
of radius 6 cm
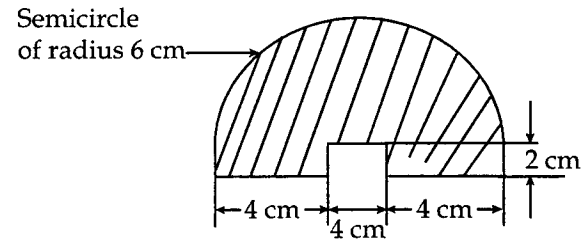
Figure

Locate the centroid and calculate the
Moment of Inertia of the section about the
horizontal and vertical centroidal axes.

(b) A body of weight 500 Newtons is lying on a   7
rough plane inclined at an angle of 25° with
the horizontal. It is supported by an Effort
(P) parallel to the plane as shown in figure
below.
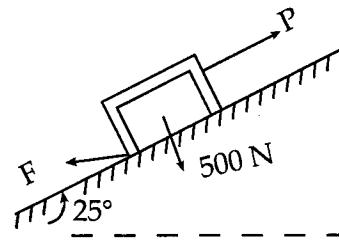
Figure

Determine the minimum and maximum
values of P, for which the equilibrium can
exist, if the angle of friction is 20°.

5. (a) A uniform ladder of weight 'W' and length 7
'L' is held in equilibrium by a horizontal
force 'P' as shown in figure below. Using
the virtual work method, Express 'P' in
terms of W and θ, where 'θ' is the angle made
by the ladder with the vertical. The contact
surfaces are smooth.
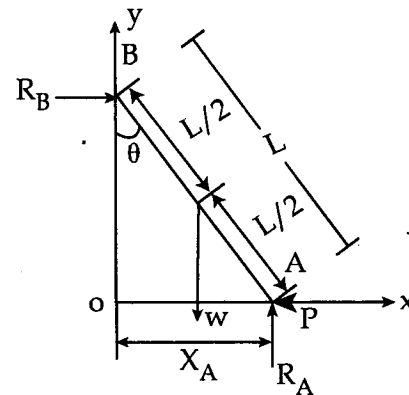
Figure

(b) On a straight road, a smuggler's car passes 7
a police station with a uniform velocity of
10 m/s. After 10 seconds a police party
follows in pursuit in a Jeep with a uniform
acceleration of 1 m/s^2. Find the time
necessary for the Jeep to catch up with the
smuggler's car.

6. (a) A particle is projected with a velocity of   7
       20 m/s in air at angle 'a' with the
       horizontal. The X and Y co-ordinates of a
       point lying on the trajectory of the particle
       with respect to point of projection are 20 m
       and 8 m respectively. Find the angle of
       projection of the particle.

   (b) A train of weight 1960 kN starts from rest   7
       and attains a speed of 120 km/hr in
       5 minutes. If the frictional resistance of the
       Track is 10 N per kN of the trains weight,
       find the average pull required.
       Take g = 9.8 m/s².

7. (a) A 10 gm bullet is shot horizontally in a   7
       wood block of mass 1 kg. The bullet gets
       embedded in the block and the block is
       displaced on a rough horizontal table
       (μ = 0.2). What was the velocity of bullet ?

   (b) Determine the forces in the members of the   7
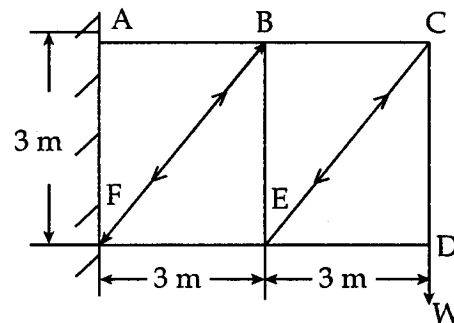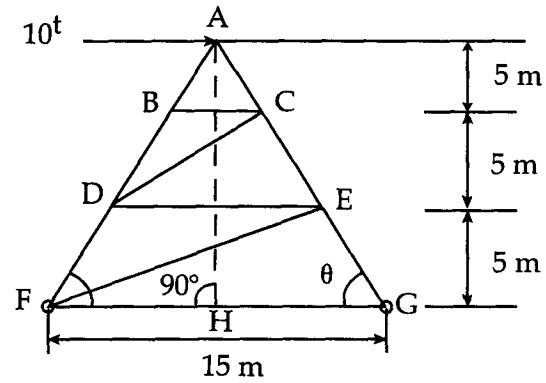   Pin-Jointed steel structure as shown in
       figure below.

Figure

8. (a) Determine the forces in the members of the   7
tower shown in figure below.

Figure

(b) The number of teeth on the worm wheel are   7
80. The radius of the effort wheel is 30 cm
and that of load cylinder is 10 cm.
Determine the load which can be lifted by
applying 200 N effort. Take efficiency as
20% when worm is

   (i) single start and

   (ii) double start.