

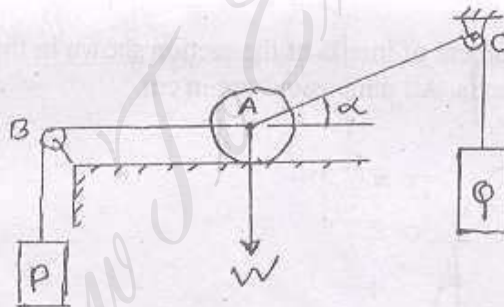
- 1) Question No 1 is compulsory.
- 2) Answer any four out of remaining six questions.
- 3) Assume any suitable data wherever required.
- 4) Marks are indicated at the right

1. Attempt any 4 questions: *Engg. Mechanics, May'07, Reg. I* (20)

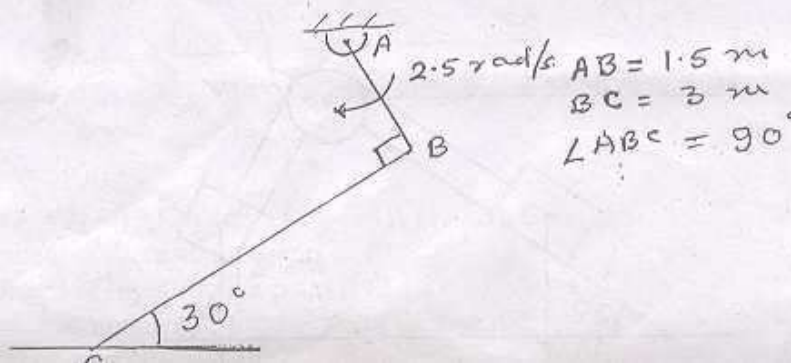
- a) State and prove Lami's theorem.
- b) A right angled lamina ABC with sides $AB = 12\text{cm}$ and $BC = 5\text{cm}$ is suspended from A as shown in the figure. Find the angle made by the side AB with the horizontal through A.



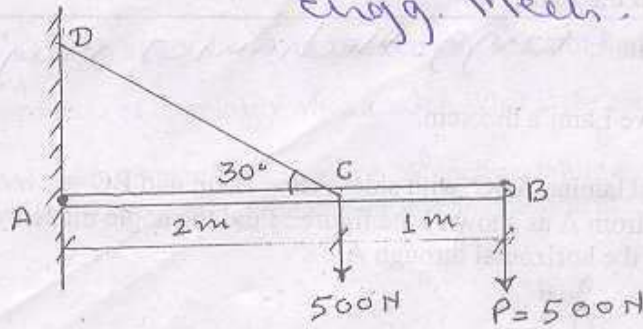
- c) A ball of weight W rests upon a smooth horizontal plane and has attached to its centre two strings AB and AC which pass over a frictionless pulley at B and C and carry load P and Q as shown in the figure. If the string AB is horizontal find the angle α that the string AC makes with the horizontal when the ball is in position of equilibrium. Also determine the pressure between the ball and the plane in terms of P, Q and W .



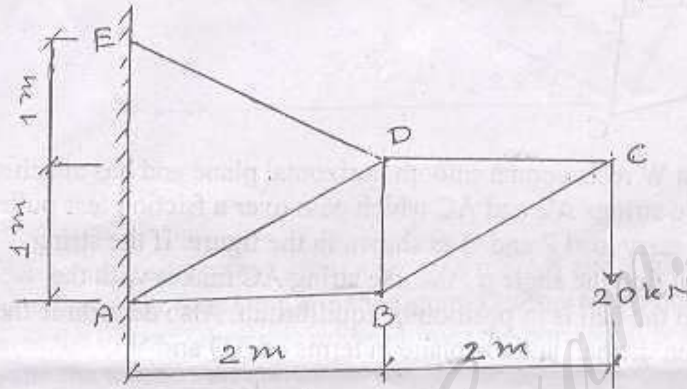
- d) Car A at a petrol pump stays there for 10 minutes after a car B passes at an average speed of 64 kmph. How long will it take for car A moving at an average speed of 80 kmph. to overtake car B?
- e) The velocity of a particle is defined by $v_x = 100 - t^{3/2}$ and $v_y = 1000 + 10t + 2t^2$ where v is in m/s and t is in sec. Determine the radius of curvature of the path when $t = 12$ sec
- f) At the instant shown in the figure, the rod AB is rotating clockwise at 2.5 rad/sec. If the end C of the rod BC is free to move on a horizontal surface find the angular velocity of rod BC and the velocity of its end point C.



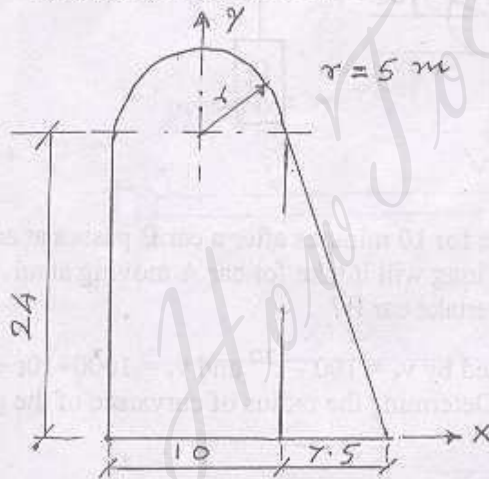
Engg. Mech. May, 07, Page 2



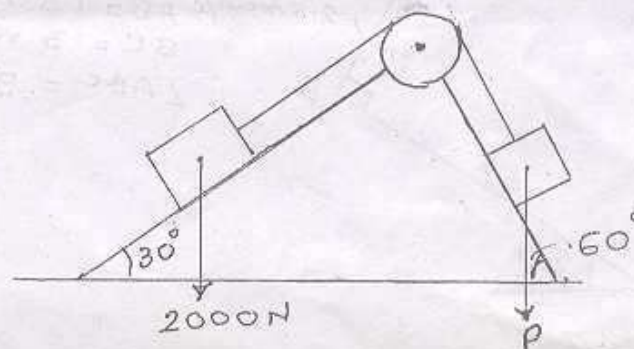
b) For the truss shown in the figure determine the axial forces in members AB, BD and DC by method of sections. and those in other members by method of joints. Tabulate your results indicating the nature of the forces also. (12)



3 a) Determine the moment of inertia of the section shown in the figure about centroidal axis parallel to y axis. All dimensions are in cm. (10)



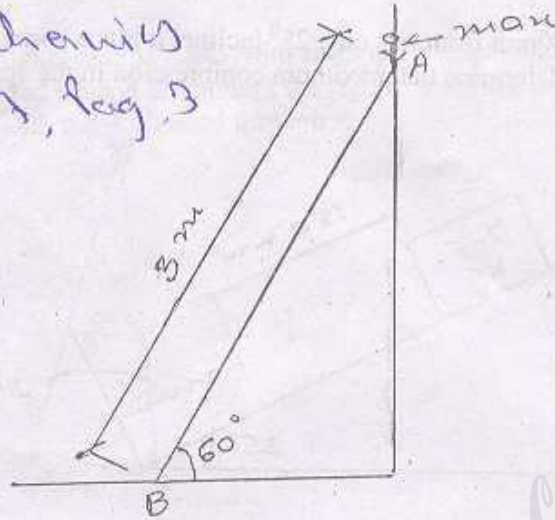
b) A block of weight 2000N rests on a smooth inclined plane that makes an angle of 30° with the horizontal. This block is supported by a load P lying on another smooth plane with inclination 60° as shown in the figure. The block and the load have been connected by an inelastic string. Determine the value of load P by using the method of virtual work. (10)



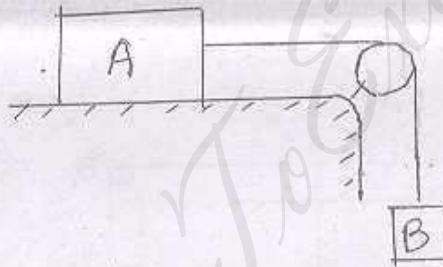
4a) A uniform ladder 3m long weighs 200N, it is placed against a wall 60° with floor as shown in the figure. Coefficient of friction between the wall and the ladder is 0.3 and that between the floor and the ladder is 0.4. The ladder, in addition to its own weight, has to support a man weighing 800N at its top at A.

- i) Calculate the horizontal force F to be applied to the floor level to prevent slipping.
- ii) If the force F is not applied, what would be the minimum inclination of the ladder with the horizontal so that there is no slipping of it with the man at the top?

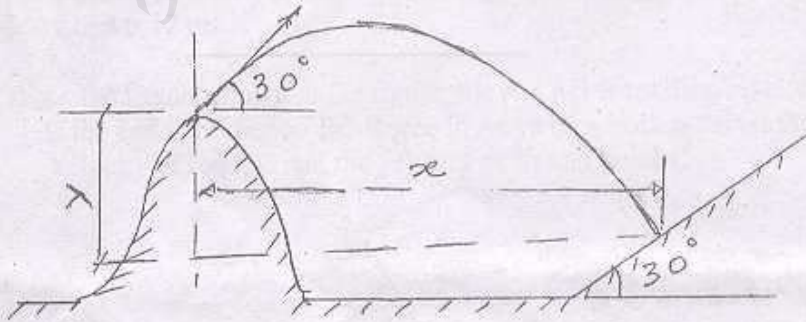
Engg. Mechanics
May 07, Pg. 3



b) Determine the acceleration of the bodies shown in fig. above if the coefficient of kinetic friction is 0.20 at all surfaces. A and B weigh 90 and 45 kg respectively. (10)



- 5 a) A ball is thrown upwards from a high cliff with a velocity of 100 m/s. at an angle of 30° with the horizontal. The ball strikes the inclined ground at right angles. if inclination of the ground is 30° as shown in the fig. below, determine: (10)
 - i) Velocity with which it strikes the ground.
 - ii) Coordinates of the point of strike with respect to point of projection.



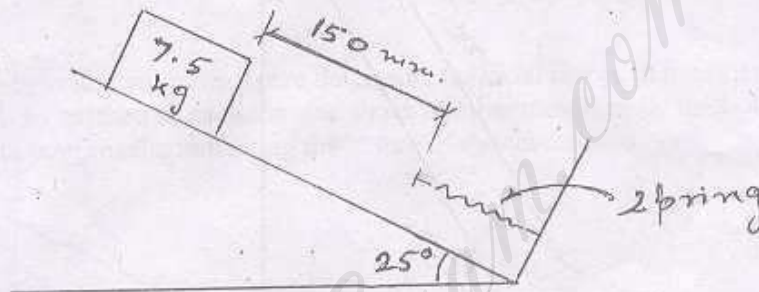
- b) A force $F = 3i - 4j + 12k$ acts at a point A (1,-2,3). Compute: (10)
 - a) Moment of force about origin.
 - b) Moment of force about a point B (2,1,2).
 - c) Vector component of force F along the line AB.

Con. 3030-ND-245-07.

6a) A vehicle traveling with a speed of 108.7 kmph undergoes a retardation which is proportional to velocity. In 58 sec, the speed gets reduced to 87.3 kmph. Establish the equation of speed as a function of time. Also find the time when the speed becomes 32.6 kmph. And the speed after 180 sec. (10)

b) A point moves along a path $y = \frac{x^2}{3}$ with a constant speed of 8 m/s. What are the x and y components of its velocity when $x = 3m$. What is the acceleration at this point? (10)

7a) A 7.5 kg mass slides 150mm from rest on a 25° incline. It hits a spring whose modulus is 1750 N/m. if $\mu=0.2$, determine the maximum compression in the spring. See fig. below. (10)



b) Consider a composite system consisting of a rod AB and a sphere with centre G fixed rigidly to the rod at B as shown in the figure. Determine the angular acceleration of the system at the instant when it is released from the horizontal position. Mass of the rod is 20 kg and the mass of the sphere = 5 kg. (10)

