Total No. of Questions: 06 **Total No of Printed Pages: 05**

F.E (Common), Examination: June - 2013

Engineering Mechanics 2008 course

[4361]-10

Time: 02 Hours **Max. Marks: 50**

Instructions:

1. Attempt **Q. 1 or Q. 2, Q. 3 or Q. 4 and Q. 5 or Q. 6.**
2. Answer should be written in one answer book.
2. Neat diagram must be drawn wherever necessary.
3. Figure to the right indicates full marks.
4. Assume suitable data, if necessary and clearly state.
5. Use of cell phone is prohibited in the examination hall.
6. Use of electronic pocket calculator is allowed.

Q. 1 a) Determine the magnitude of the resultant force and its direction, measured counterclockwise from the positive x-axis as shown in **Fig. 1 a**. **(06)**

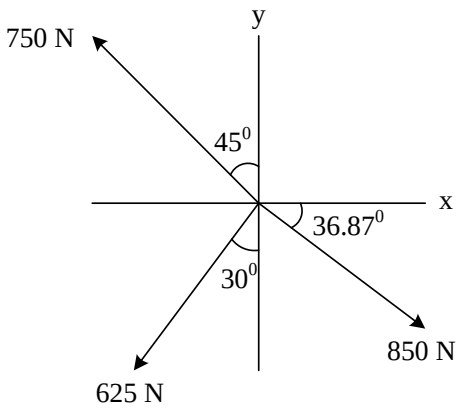

Fig. 1 a

b) A bicyclist starts from rest and after traveling along a straight path a distance of 20 m reaches a speed of 30 kmph. Determine the constant acceleration and how long does it take to reach the speed of 30 km/h. **(06)**

OR

Q. 2 a) Determine the position of centroid of the shaded area as shown in **Fig. 2 a** with respect to origin O. **(06)**

b) The conveyor belt is designed to transport packages of various weights. Each 50 kg package has a coefficient of kinetic friction μ_k = 0.20. If the speed of the conveyor is 25 m/s, and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest. Refer **Fig. 2 b**. **(06)**

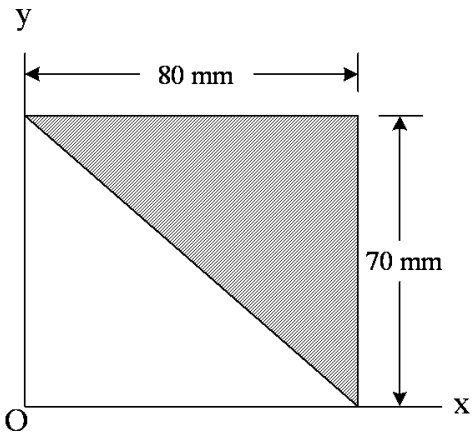

Fig. 2 a

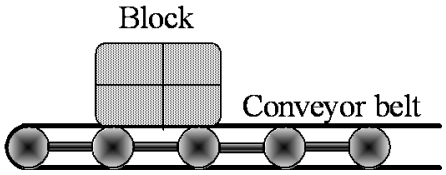

Fig. 2 b

Q. 3 a) Spheres A having mass 200 kg held in equilibrium as shown in **Fig. 3 a**. Determine the normal reactions at the point of contact. **(06)**

b) Three forces are acting on a plate of as shown in **Fig. 3 b**. Find magnitude and point of application of resultant force on the plate. **(07)**

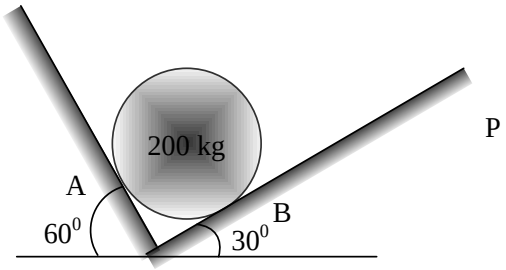

Fig. 3 a

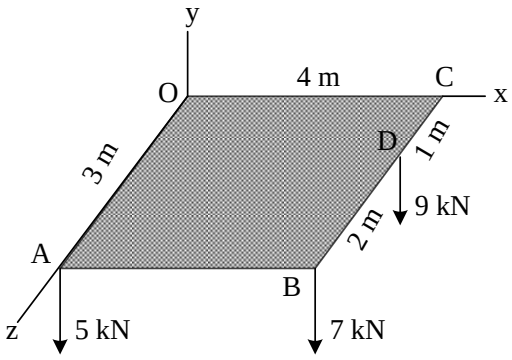

Fig. 3 b

c) A particle position is describe by the coordinates r = (2sin 2θ) m and θ = (4t) rad, where t is in seconds. Determine the radial and transverse components of its velocity when t = 1 s. **(06)**

OR

Q. 4 a) Determine the support reaction for the beam loaded and supported as shown in **Fig. 4 a**. **(06)**

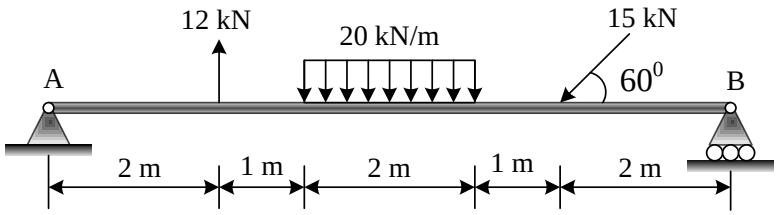

Fig. 4 a

b) An electric pole OA of height 30 m is held by three ropes to a pin at A and anchored at B, C and D as shown in **Fig. 4 b**. If the tension in rope AC is 2.6 kN, determine the vertical force P exerted by the pole on the pin at A. **(07)**

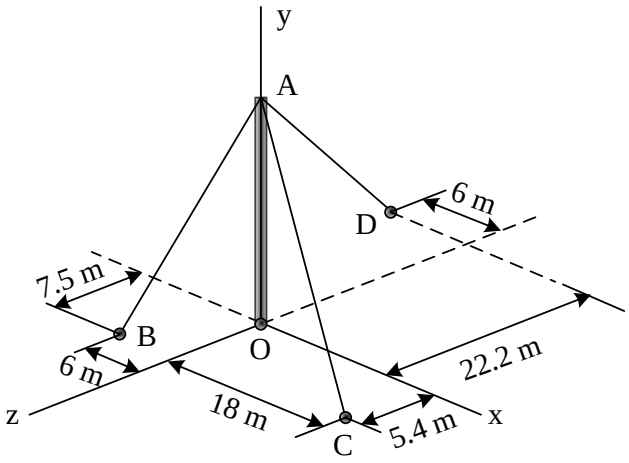

Fig. 4 b

c) Determine the maximum constant speed at which the pilot can travel around the vertical curve having a radius of curvature ρ = 800 m, so that he experiences a maximum acceleration $a_n = 8g = 78.5\ m/s^2$. If he has a mass of 70 kg, determine the normal force he exerts on the seat of the airplane when the plane is traveling at this speed and is at the lowest point. Refer **Fig. 4 c**. **(06)**

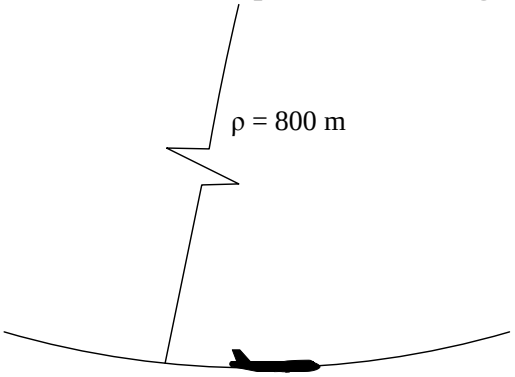

Fig. 4 c

Q. 5 a) The locomotive of a train exerts a constant pull of 400 kN on the cars, which have a total mass of 2 x 10^6 kg. The cars have a total frictional resistance of 6.5 kN and are originally traveling at 2 m/s up a slope of 1^0. Determine the speed of the cars after they travel 2 km. **(06)**

b) A cord having a weight of 0.5 N/m and a total length of 10 m is suspended over a peg P as shown in **Fig. 5 b**. If the coefficient of static friction between the peg and cord is 0.5, determine the longest length h which one side of the suspended cord can have without causing motion. Neglect the size of peg and length of cord draped over it. **(06)**

c) Determine the force in each member of the truss and state the members are in tension or compression. Refer **Fig. 5 c**. **(07)**

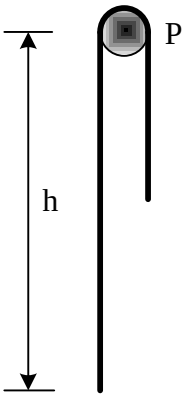

Fig. 5 b

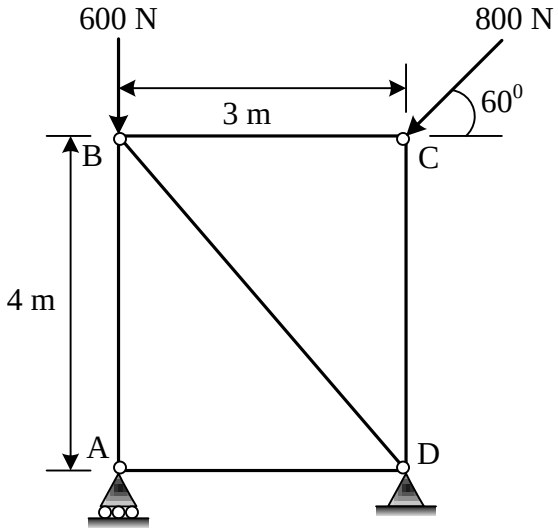

Fig. 5 c

OR

Q. 6 a) Cable ABCD supports two point load at point B and C as shown in **Fig. 6 a**. Determine the maximum tension in the cable segment and the sag of point B. **(07)**

b) Determine the smallest angle θ at which the ladder shown in **Fig. 6 b** can be placed against the side of smooth wall without having it slip. **(06)**

c) A jet plane has a mass of 250 Mg and a horizontal velocity of 100 m/s when t = 0. If the engines provide a resultant horizontal thrust F = (200 + $2t^2$) kN, where t is in seconds. Determine the plane's velocity in t = 5 s. Neglect air resistance and the loss of fuel during the motion. **(06)**

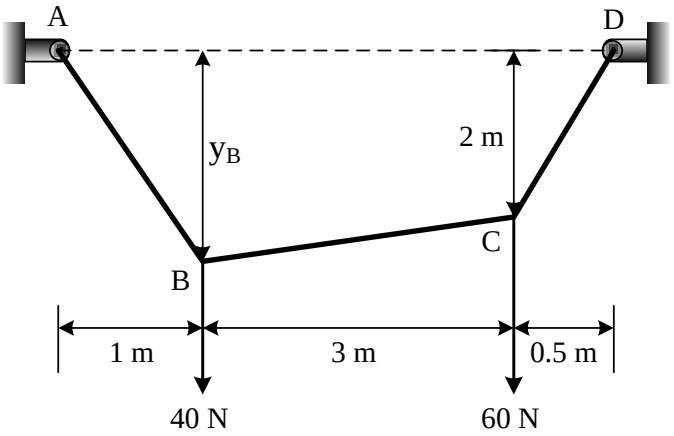

Fig. 6 a

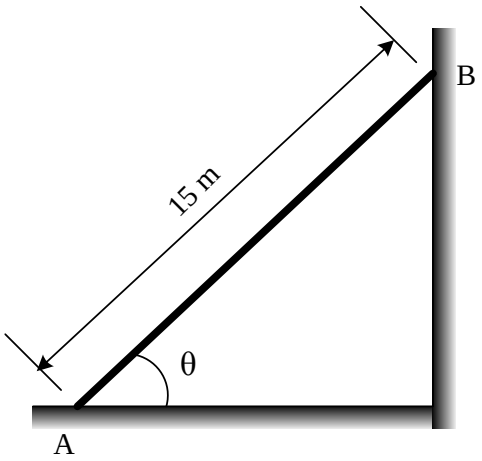

Fig. 6 b

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