FE | Sem-2 | CBGS | EM | 18/05/18

Sub:- Engineering Mechanics

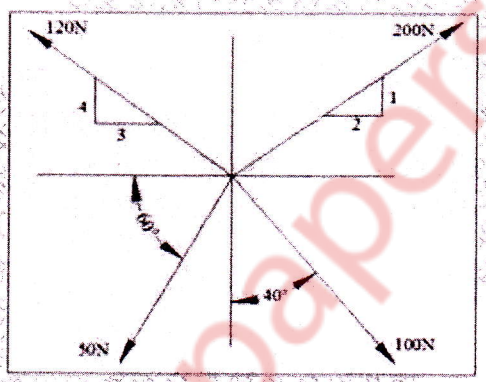
Q. P. Code: 27956

(3Hours)

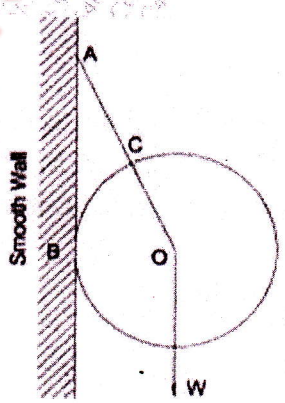
Maximum Marks : 80

N.B.1. Question No. 1 is Compulsory.
2. Answer any Three more questions out of the remaining Five questions.
3. Assume any suitable data wherever required but justify the same.
4. Figures to the right indicate full mark
5. Take g= 9.81m/s^2

Q1a) A system of four forces acting on a body is shown in fig. Determine their resultant. [4]



b) A smooth sphere of wt. 500N is supported in contact with smooth vertical wall by a string fastened to a point on its surface, the end being attached to a point on the wall. If the length of the string AC is equal to the radius of sphere OC, determine the tension in the string and reaction at the wall. [4]



c) Explain: (i)Laws of friction (ii) Angle of repose [4]

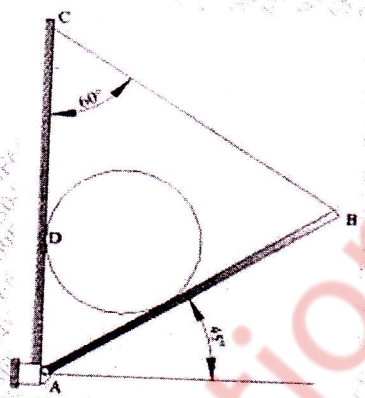
d) A particle starts from rest at t=0 and travels in one particular direction. Its rectilinear motion is given by the relation $v = (9t^2 - 18t)$ m/s where t is in seconds. Determine the time at which the particle reaches its maximum displacement. Also determine its displacement and acceleration at t=2 sec [4]

e) A car travelling at a speed of 25m/s suddenly applies brakes and comes to stop after skidding 100 m. Determine

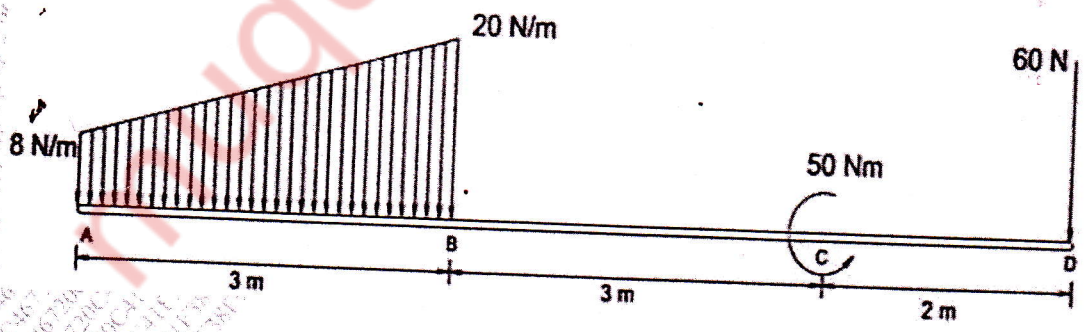
(i) Time need to stop the car

(ii) Coefficient of friction between the tyre and the road [4]

Q2a) A cylinder 1.5m in diameter & weight 1000N is a supported by a beam AB of length 6m & weight 400N as shown in fig. Neglecting friction determine (i) Wall reaction at D (ii) Tension in the cable BC (iii) Reaction at hinge support A. [8]

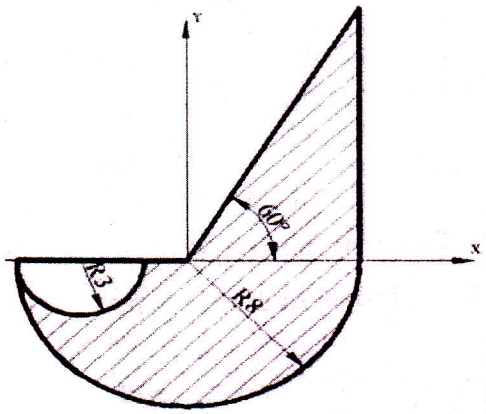


b) Determine the magnitude, direction and position of the single resultant force. Also replace the given system by a Force-Couple at B. [6]

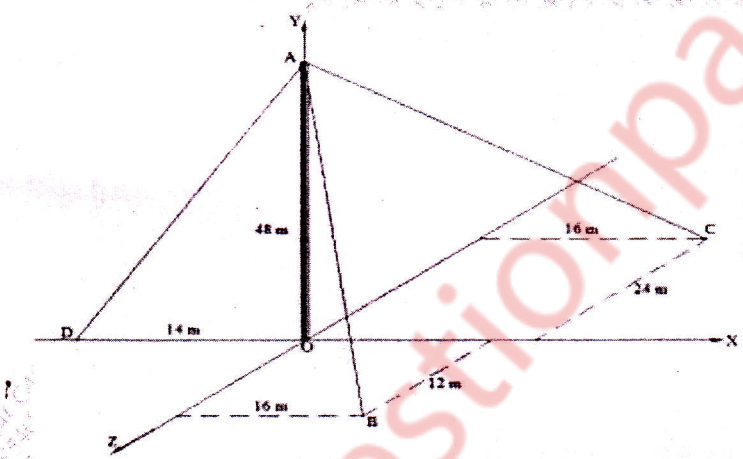


c) A 2kg ball moving with 0.4m/s towards right collides with another ball of mass 3kg moving with 0.5m/s towards left. Determine the velocities of the balls after impact & the corresponding percentage loss of K.E. Coefficient of restitution e=0.7 [6]

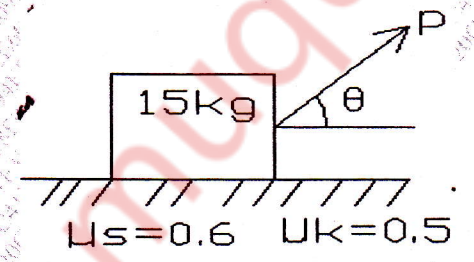
Q3.a) Determine the Centroid of the shaded area. All dimensions are in mm. [8]



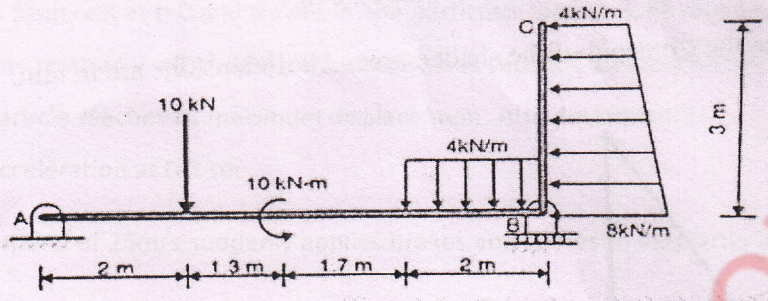
b) Knowing that the tension in AC is 20kN, determine the required value of tension in cable AB & AD so that resultant of the three forces applied at A is vertical & calculate the resultant. [6]



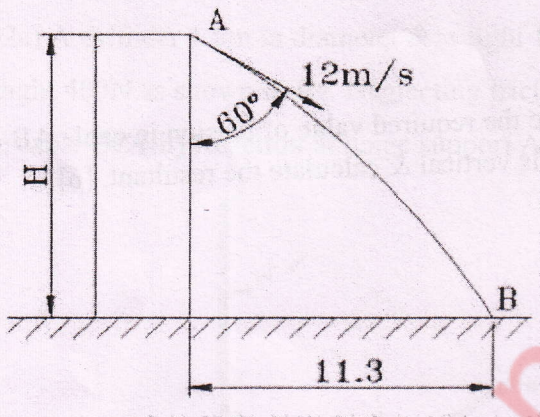
c) A block with a mass of 15kg is acted upon by a force P=30N at an angle $\theta=30^0$as shown. Determine the velocity of the block after a displacement of 5m. The block is initially at rest. Take $\mu_s = 0.6$ and $\mu_k=0.5$ [6]



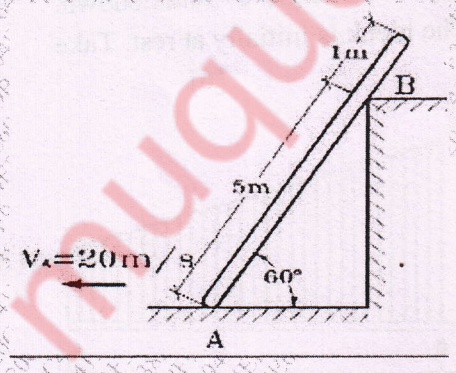
Q4.a) Find support reactions at A and B for the beam loaded as shown in figure. A is hinged and B is roller. [8]



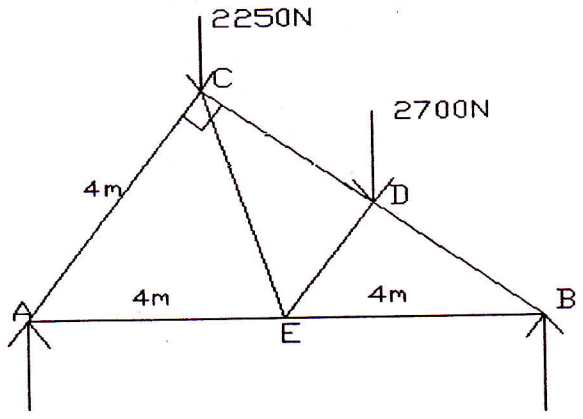
b) A ball thrown with speed of 12 m/s at an angle of 60° with a building strikes the ground 11.3 m horizontally from the foot of the building as shown. Determine the height of the building. [6]



c) Velocity of point A on rod is 20 m/s at the instant shown in figure. Locate ICR for the rod and determine velocity of point B on the rod. [6]

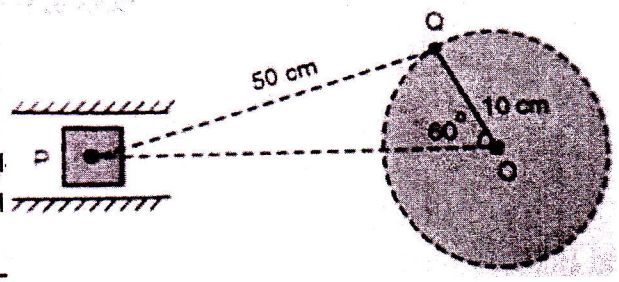


Q5a) Find the magnitude and nature of forces in members AE, CE and CD by method of sections and rest of the members by method of joints. A and B are supported as shown. Length AC=AE=CE=BE=4m and angle ACB=90^0 [8]

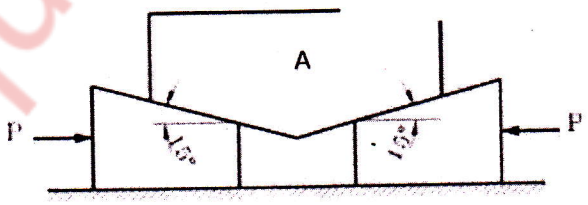


b) A train leaves station A and attains speed at the rate of 4m/s^2 for 6 seconds and then 6m/s^2 till it reaches a velocity of 48m/s. Further the velocity remains constant,then brakes are applied giving the train a constant deceleration stopping it in 6 seconds. If the total running time between the two stations is 40sec. Plot a-t graph, v-t graph and determine the distance between the two stations. [6]

c) The crank OQ of a slider crank mechanism is rotating at constant speed of 30 rpm clockwise about fixed point O. Determine the velocity of the piston P at the given instant. [6]



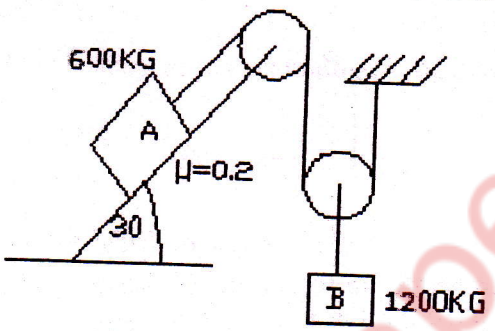
Q6a) What force P must be applied to the weightl under 1000 kN block A? The angle of friction at al



b) A force of 600N acts along PQ, P(4,5,-2) and Q (-3,1,6)m. Calculate its moment about a point A(3,2,0) . [4]

c) A car starts from rest and moves along a circular path having a radius of 20m. Its speed increases at a uniform rate of 0.5 m/s^2. Find the time from the start and distance travelled when its resultant acceleration becomes 1.5 m/s^2. [4]

d) Blocks A and B of mass 600kg and 1200kg respectively are connected by a string passing over a smooth pulley. Neglect mass of pulley. If coefficient of kinetic friction between the block A and the inclined surface is 0.2, determine the acceleration of block A and block B. [4]



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