FE - Sem-I (CBGS) 16/5/16

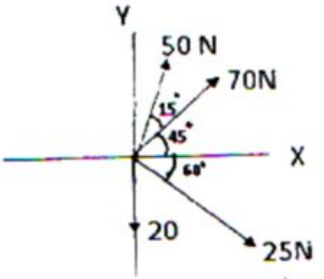
Engg Mechanics.

QP Code : 28584

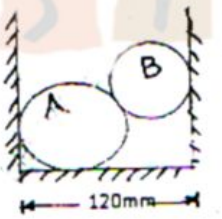
(3 Hours) [Total Marks 80

N.B.: (1) Question No. 1 is compulsory.
(2)Attempt any three questions from remaining five questions.
(3)Assume suitable data if necessary and mention the same clearly.
(4)Take g=9.81 m/s^2

Q.1 a. Determine the resultant of the forces acting as given in figure below. Find the angle which the resultant makes with the positive x-axis. [4]



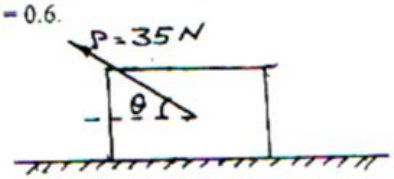
b. Two spheres A and B are kept in a horizontal channel. Determine the reactions coming from all the contact surfaces. Consider the radius of A and B are 40mm and30mm respectively. Take W_A =500 N and W_B = 200N. [4]



c. Define Angle of Friction and Angle of Repose [4]

d. Car A starts from rest & accelerates uniformly on a straight road. Another car B starts from the same place 5 seconds later with initial velocity zero & it accelerates uniformly at 5 m/sec^2. If both the cars overtake at 500 m from the starting place, find the acceleration of car A. [4]

e. Find the angle the force P makes with horizontal such that the block of mass 4 kg has an acceleration of 10m/sec^2, when it is subjected to a force of 35 N. μs = 0.7, μk = 0.6. [4]



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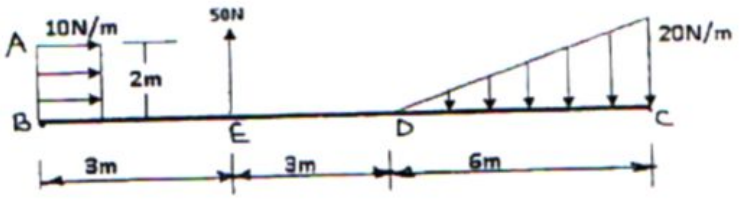
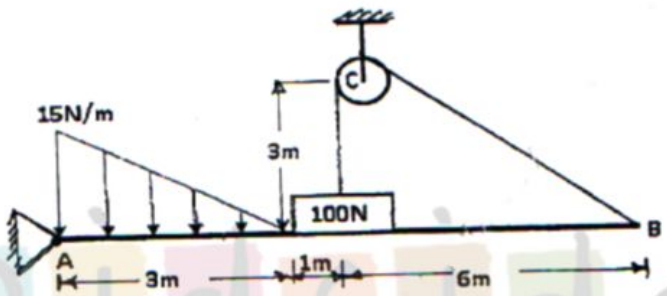
Q.2 a. Replace the force system by a single force w. r. to point C [6]

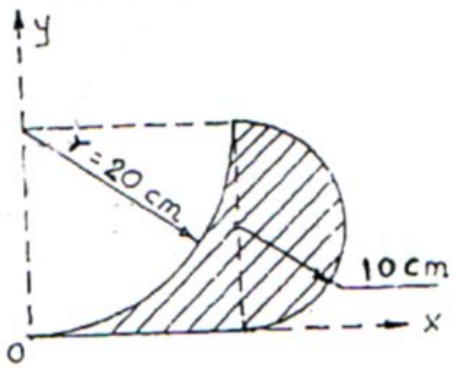


b. A uniform beam AB hinged at A is kept horizontal by supporting & setting a 100 N weight by using a string tied at B & passing over a smooth pulley at C The beam also loaded as shown in figure below. Find the reactions at A & C [8]



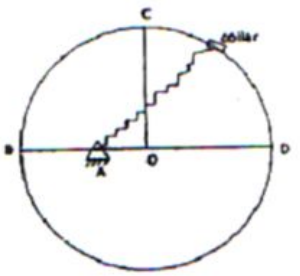
c. Prove that for a perfectly elastic body, two equal masses participating in collision exchange their velocities. [6]

Q.3 a. Find Centroid of shaded area with reference to X and Y axes. [8]

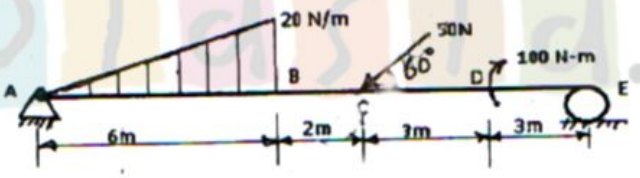


b. Find the resultant of the spatial concurrent force system concurrent at A(1,0,0) and passing through points B(-1,3,5), C(3,5,7), D(0,4,0). Magnitude of forces F_{AB}= 100N, F_{AC} =150N, F_{AD}=200N. [6]

c. A collar of mass 1 kg is attached to a spring ad slides without friction along a circular rod which lies in a horizontal plane. The spring is undeformed when the collar is at B. knowing that the collar is passing through the point D with a speed of 1.8 m/s, determine the speed of the collar when it passes through point C and B. Take Stiffness of the spring, k= 250 N/m, Radius of the circular path = 300 mm and distance OA = 125 mm. [6]

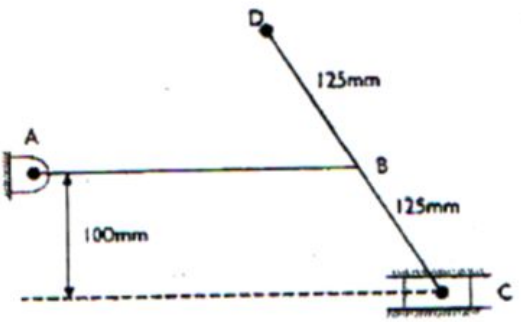


Q.4 a. Find the reactions at supports A and E for the beam loaded as shown in the figure below. [8]



b. A fighter Plane Moving horizontally with a constant velocity of 200 m/seconds releases a bomb from an altitude of 400 m. Find the velocity and direction of the bomb just before it strikes the ground. Also determine the distance travelled by the plane before the bomb just strikes the ground. [6]

c. Find velocity of C and point D at the instant shown ω_{AB} = 3 rad /sec clockwise. AB =400mm. [6]



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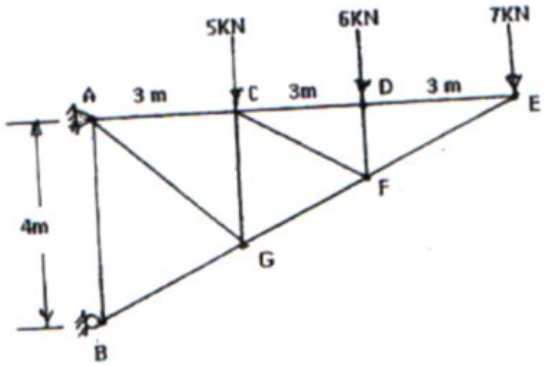
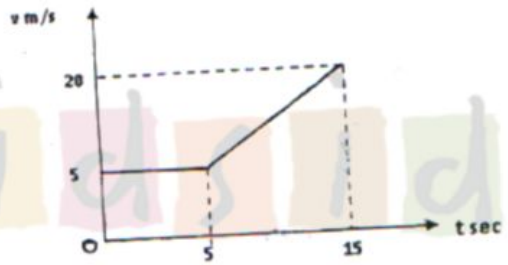
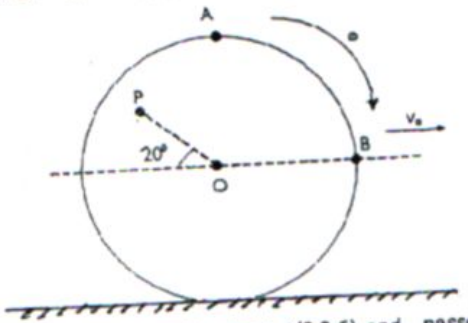
Q.5 a. Find the forces in CF and CD by method of section and the remaining by Method of Joints. [8]



b. For a vehicle moving along a straight line, v-t diagram is as shown in figure below. Plot a-t & s-t diagrams for the given time period. [6]



c. A wheel is rolling along a straight path without slipping. Determine velocity of points A,B and P. OP = 600mm, ω = 4 rad/sec, Vo = 4m/s [6]



Q.6 a. A force of magnitude 500N is acting from A(2,3,6) and passes through a point B(6,2, 6). Compute its moment about point C(4, 6, 3). [4]

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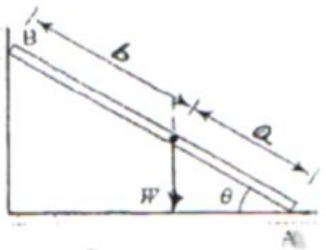
b A stone is thrown with a velocity (u) m/sec at an angle of 20^0 with horizontal from a point 2 m above the ground. The stone strikes the ground 5 m away from the original position. The motion of stone is subjected to gravitational acceleration & wind resistance of 0.82 m/sec^2 , opposing the horizontal motion. Determine the time of flight of the stone. [4]

c. A heavy metal bar AB rests with its lower end A on a rough horizontal floor having coefficient of friction μ_F & the other end B on a rough vertical wall having coefficient of friction μ_W. If the centre of gravity of the bar is at distances a & b from the ends A & B respectively, show that at impending motion, the inclination of the bar with the horizontal will be: [8]

$$\theta = \tan^{-1}\left(\frac{1}{\mu_F}\frac{a - b\mu_F\mu_W}{a + b}\right)$$



d. Two masses are interconnected with the pulley system Neglecting inertial & frictional effect of pulleys & cord, determine the acceleration of the mass m_2. Take $m_1 = 50$ kg & $m_2 = 40$ kg [4]