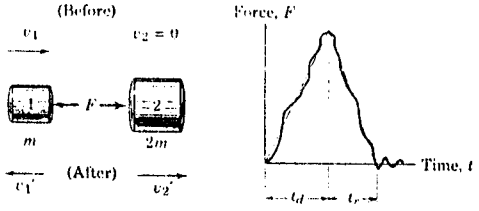
MS Entrance Exam 1997 - Engineering Mechanics (Dynamics) Jenq

(20%)(1) (a)(10%)When we study the impact problem of two particles, it shows that the coefficient of restitution (e) can be written as

e={|relative velocity of separation|}/{|relative velocity of approach|}.

Can you explain (i) how above equation is obtained? (ii) when deriving (or formulating) above equation, what assumptions have been applied?

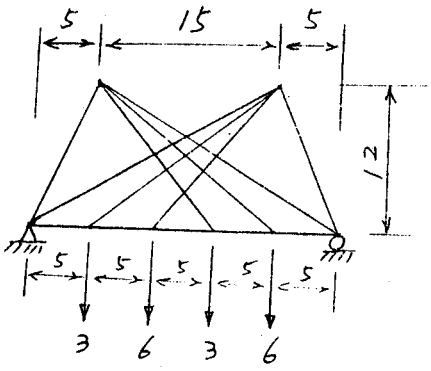
(b)(10%)Cylinder 1 of mass 'm' moving with a velocity v_1 strikes cylinder 2 of mass '2m' initially at rest. The impact force 'F' varies with time as shown, where t_d is the duration of the deformation period and t_r is the duration of the restoration period. Determine the velocity v_2' of cylinder 2 immediately after impact in terms of the initial velocity v_1 of cylinder 1 for (i) $t_r = t_d$ and (ii) $t_r = 0.5t_d$.



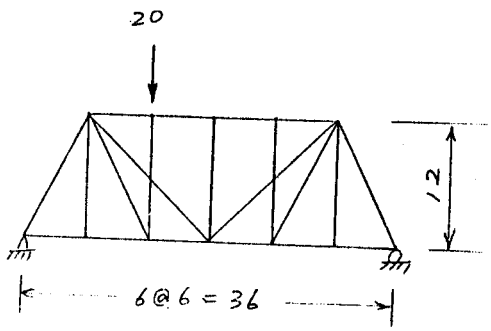
(20%)

(2). Determine the force in each member of the trusses shown below (20%)

(a)

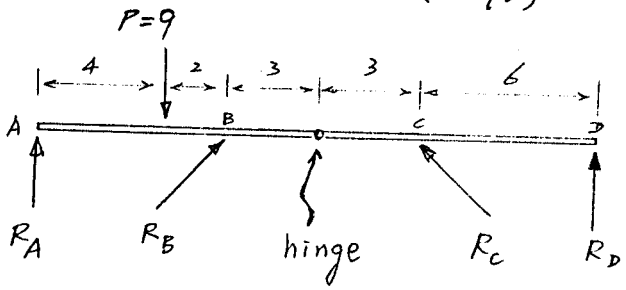


(b)



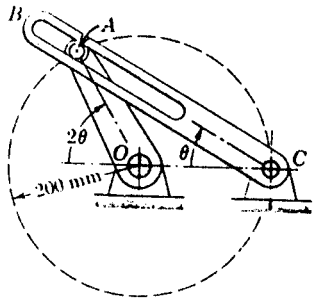
(20%)

(3). Find reactions R_A, R_B, R_C, R_D at points A, B, C, D on the beam. The load P = 9. Draw shear force and bending moment diagram of the beam. (20%)



(20%) (4)

The crank OA revolves clockwise with a constant angular velocity of 10 rad/s within a limited arc of its motion. For the position $\theta = 30°$ determine the angular velocity of the slotted link CB and the acceleration of A as measured relative to the slot in CB.



(20%) (5)

Above the earth's atmosphere at an altitude of 400 km where the acceleration due to gravity is 8.69 m/s^2 a certain rocket has a total remaining mass of 300 kg and is directed 30° from the vertical. If the thrust T from the rocket motor is 4 kN and if the rocket nozzle is tilted through an angle of 1° as shown, calculate the angular acceleration α and the x- and y-components of the acceleration of the mass center G. The rocket has a centroidal radius of gyration of 1.5 m.