BT-MRE-I&II(SS)-06.20-1344 Reg. No. | | | | | | | | |

C

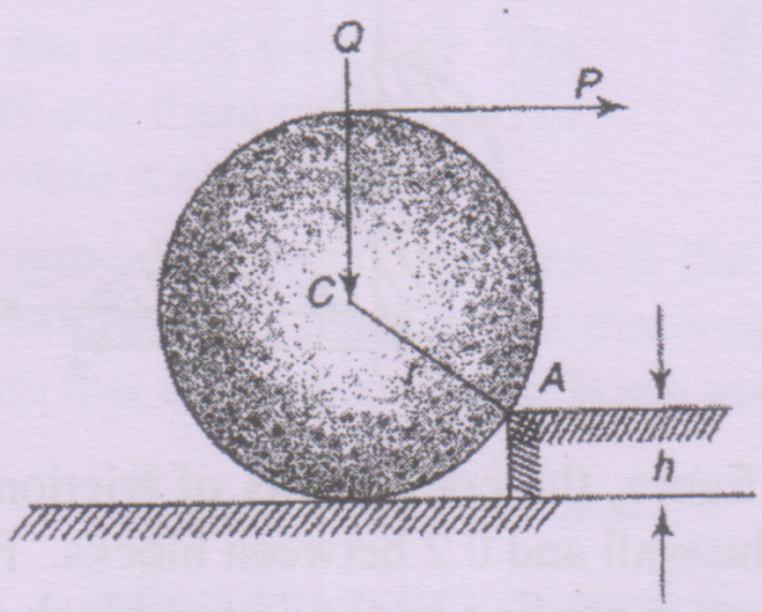
B.Tech. Degree I & II Semester Special Supplementary Examination in Marine Engineering June 2020

MRE 1105 ENGINEERING MECHANICS

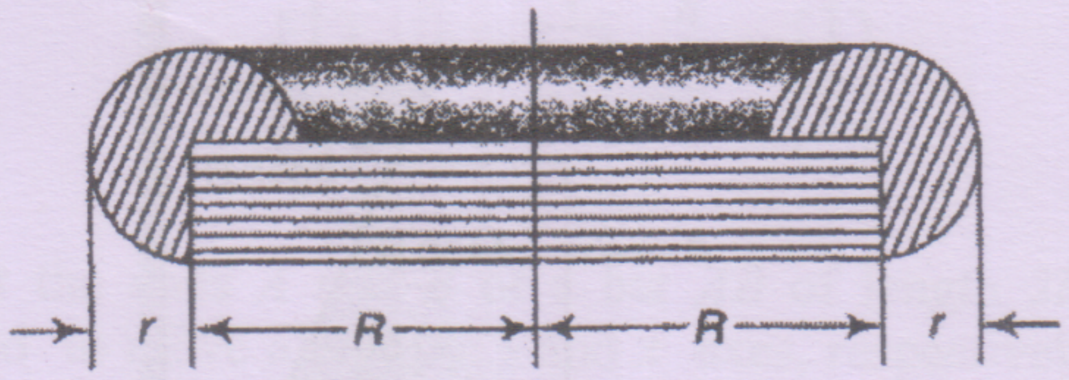
(Prior to 2013 Scheme)

Time: 3 Hours Maximum Marks: 100

I. (a) A roller of radius r = 304.8 mm and weight Q = 2225 N is to be pulled over a curb of height h = 152.4 mm by a horizontal force P applied to the end of a string wound around the circumference of the roller as in figure find the magnitude of P required to start the roller over the curb. (8)

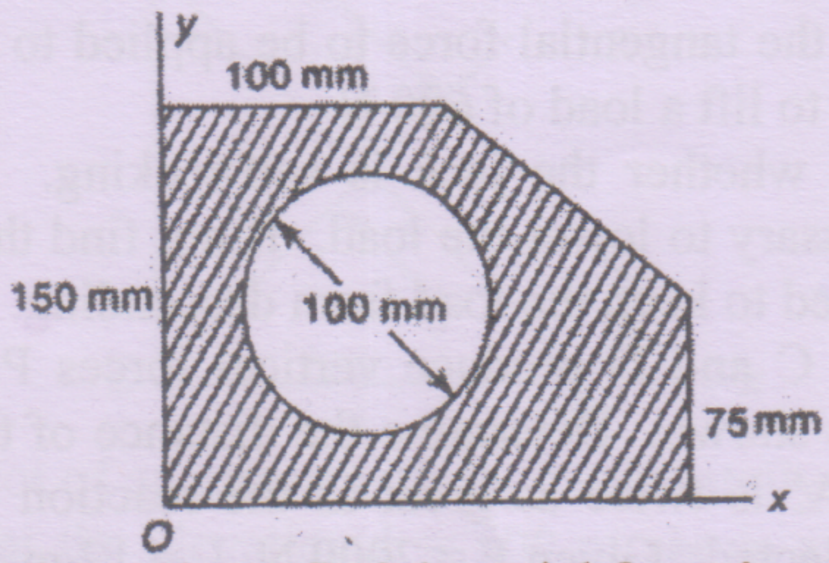


(b) Using the second theorem of Pappus, calculate the volume of the ring shown in the figure if R = 250 mm, r = 100 mm. (8)

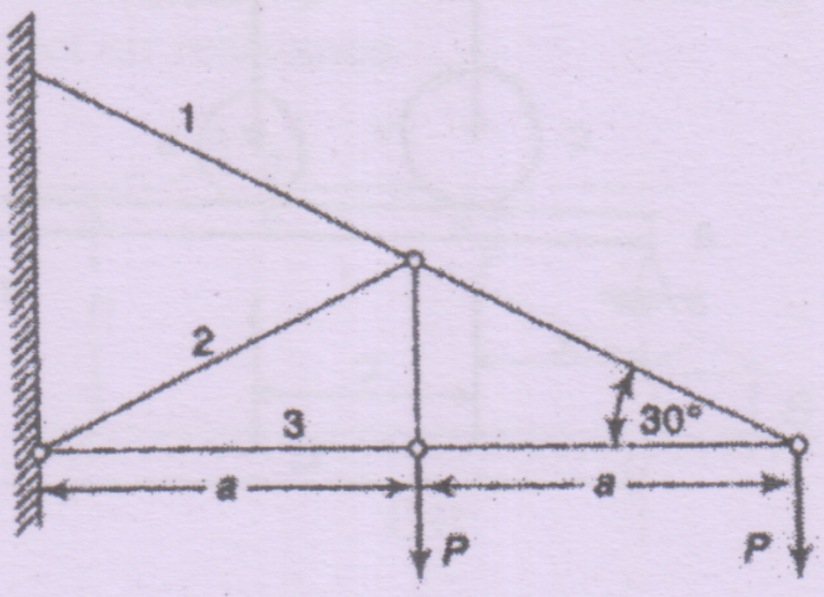


OR

II. (a) Referring to figure determine the coordinates x_c and y_c of the centre of a 100 mm diameter, circular hole cut in a thin plate so that this point will be the centroid of the remaining shaded area. (8)



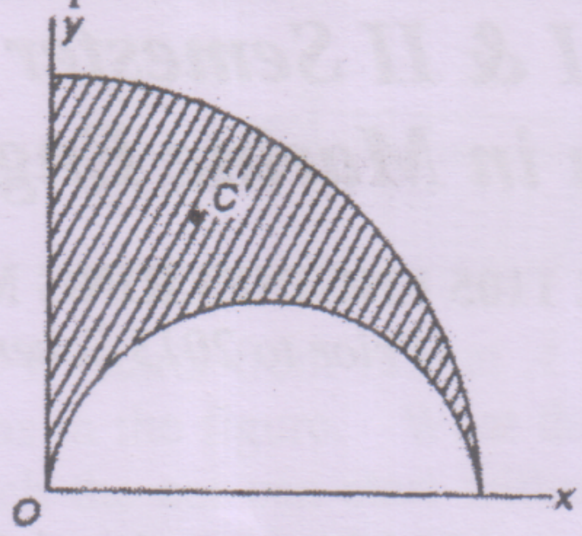
(b) Using the method of sections, find the axial force in each of the bars 1, 2, 3 of the plane truss in figure. (8)



(P.T.O.)

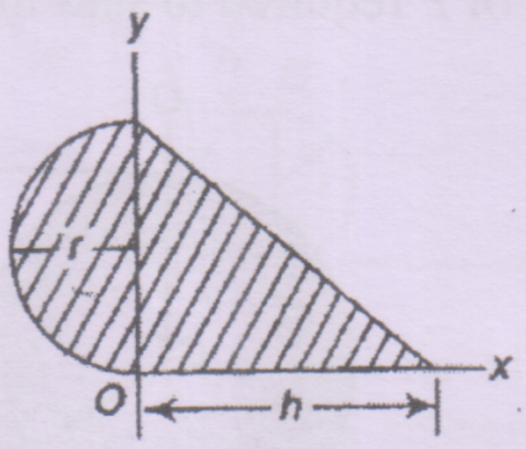
III. (a) State and prove theorem of parallel axis. (9)

(b) Locate the centroid *C* of the shaded area obtained by cutting a semicircle of diameter '**a**' from the quadrant of a circle of radius a as shown in figure. (8)

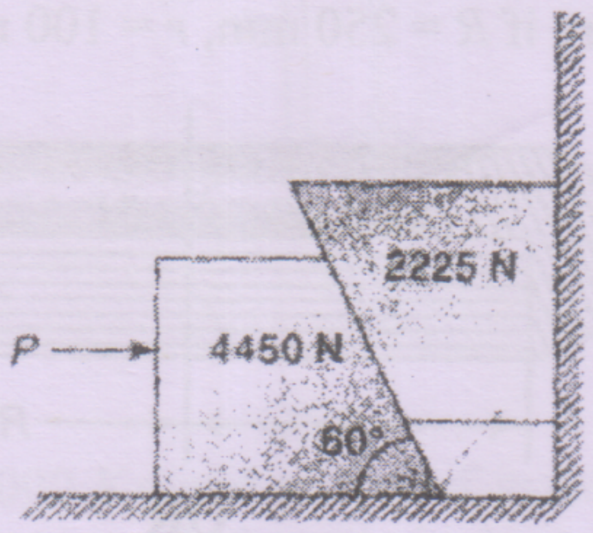


OR

IV. Referring to figure finds the necessary relationship between *r* and *h* so that *x* and *y* will be principal axes for the composite area. (17)



V. Referring to figure, the coefficients of friction are as follows; 0.25 at the floor, 0.3 at the wall and 0.2 between blocks. Find the minimum value of a horizontal force p applied to the lower block that will hold the system in equilibrium (17)



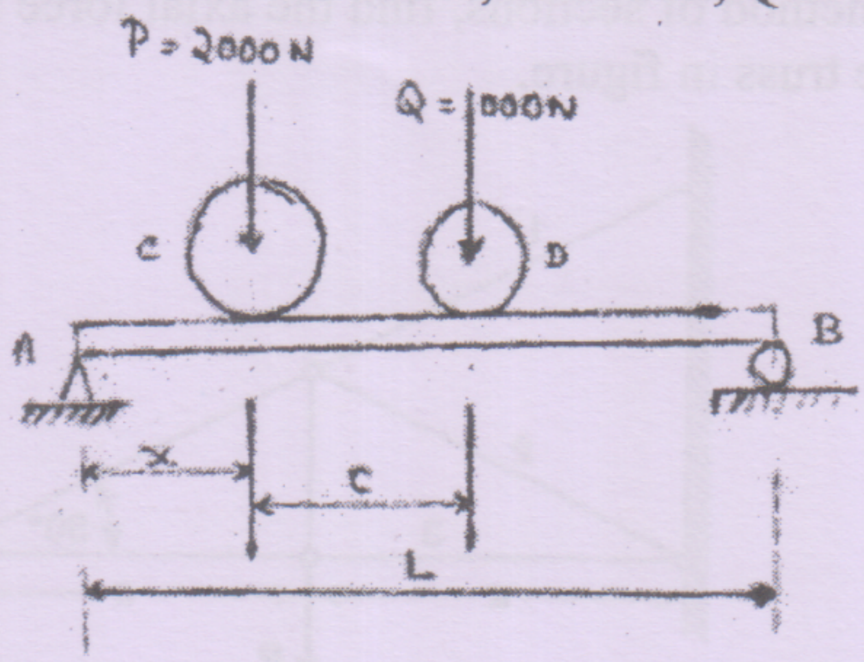
OR

VI. (a) A screw-jack has a square thread, 7.5 cm mean diameter and 1.5 cm pitch. The load on the jack revolves with the screw. The co-efficient of friction at the screw threads is 0.05. (9)

(i) Find the tangential force to be applied to the jack at 36 cm radius so as to lift a load of 600 N

(ii) State whether the jack is self-locking. If it is find the torque necessary to lower the load. If not find the torque, which must be applied to keep the load from descending.

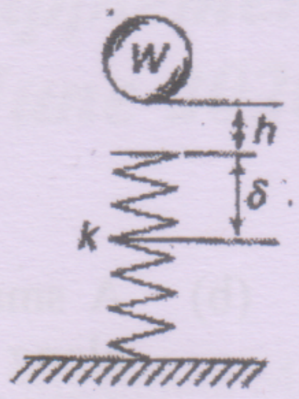
(b) Two rollers C and D produce vertical forces P and Q on the horizontal beam AB as shown. Determine the distance of the load P from "A" if the reaction 'RA' is twice as great as the reaction 'Rb'. The weight of the beam is neglected. Given P = 2000 N, L = 12 m, Q = 1000 N, C = 3 m. (8)



(Continued to 3)

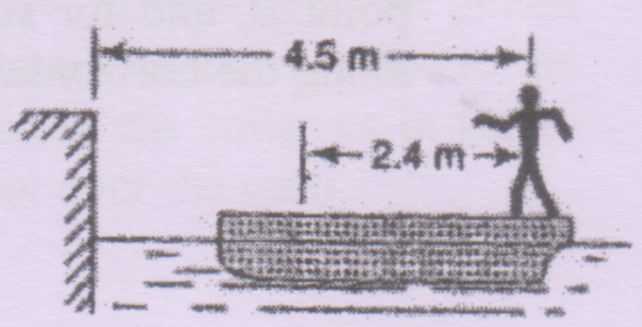
VII. (a) A train uniformly retarded to rest in 80 seconds. If during the first 40 seconds it covers 120 m determine its initial speed before the power was cut off and the total distance travelled. (8)

(b) When a ball of weight W rests on a spring of constant k shown as in figure, it produces a static deflection of 25 mm. How much will the same ball compress the spring if it is dropped from a height h = 0.3 m? Neglect the mass of the spring. (8)

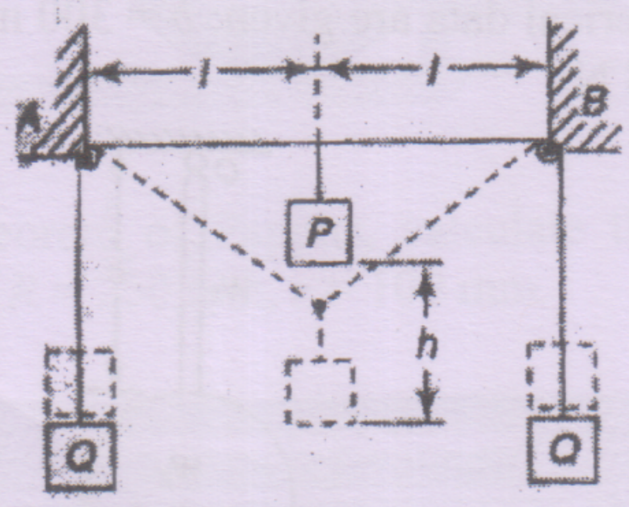


OR

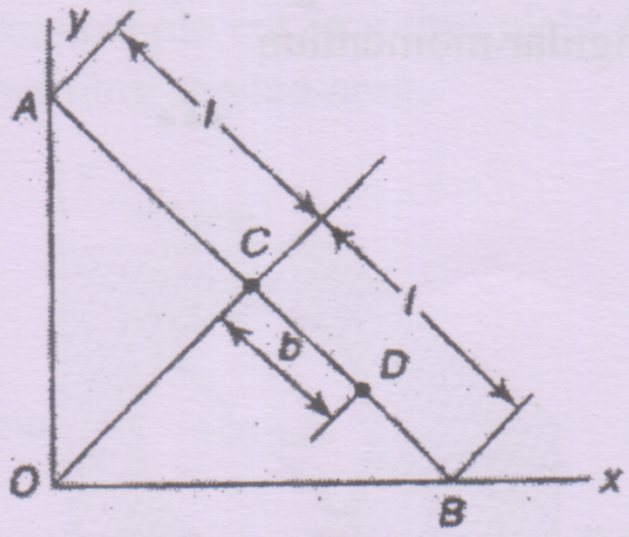
VIII. (a) A man weighing 712 N stands in a boat so that he is 4.5 m from a pier on the shore as in Fig. He walks 2.4 m in the boat towards the pier and then stops. How far from the pier will he be at the end of walking? The boat weights 890N and there is assumed to be no friction between it and the water. (8)



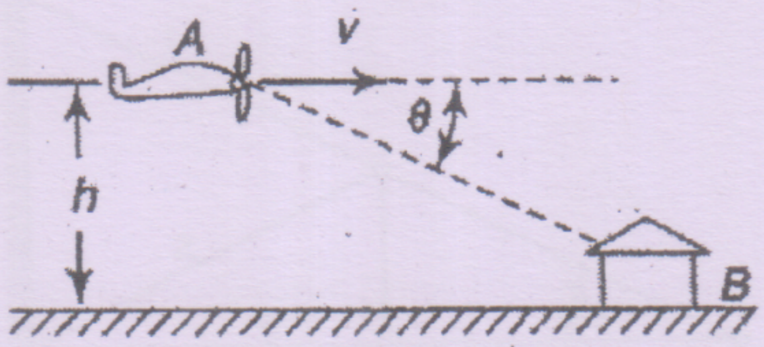
(b) If the system in Figure is released from rest in the configuration shown by solid lines, find maximum distance h that the weight P will fall. Neglect friction and assume that the pulleys A and B are very small. (8)



IX. (a) Prove that the ends A and B of a bar AB of length $2l$ as in figure are constrained to move along the y and x axes, respectively its mid-point C describes a circle of radius l with centre at O while any intermediate point D describes an ellipse with major and minor semiaxes $l + b$ and $l - b$, respectively. (9)

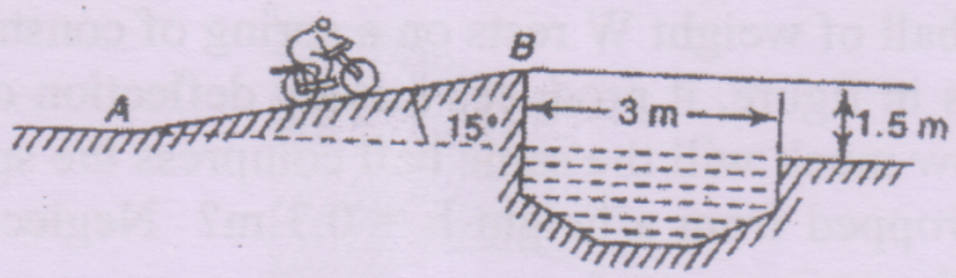


(b) In figure the pilot of an airplane flying horizontally with a constant speed $v = 480$ kmph at the elevation $h = 600$ m above a level plane wishes to bomb a target B on the ground. At what angle θ below the horizontal should he see the target at the instant of releasing the bomb in order to score a hit? Neglect air resistance. (8)

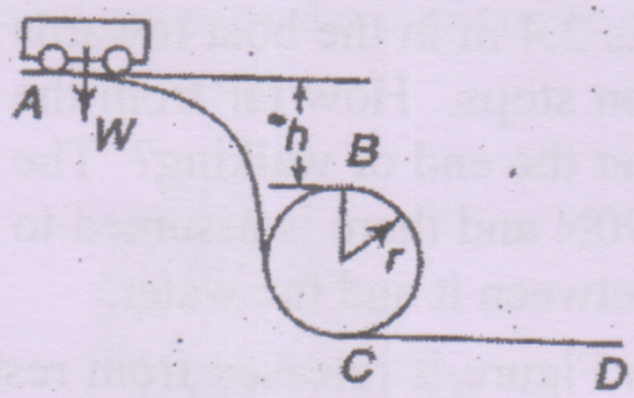


OR

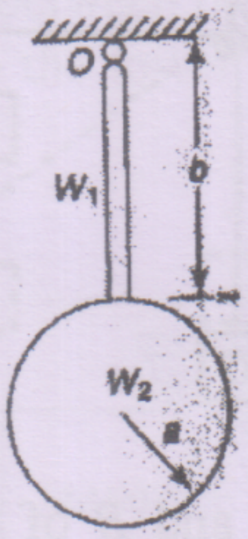
X. (a) Referring to figure calculate the minimum speed v_0 with which a motorcycle stunt rider must leave the 15° ramp at B in order to clear the ditch. (9)



(b) A small car of weight W starts from rest at A and rolls without friction along the loop $ACBD$ as in the figure. What the least height h above the top of the loop at which the car can start without falling off the track at point B, and for such a starting position what velocity will the car have along the horizontal portion CD of the track? Neglect friction. (8)



XI. Determine the period of small oscillations of the compound pendulum shown in figure and consisting of a disk suspended by a slender rod if the following numerical data are given: $b = 300$ mm, $a = 125$ mm, $W_1 = 2.225$ N and $W_2 = 13.35$ N (17)



OR

XII. A flywheel of mass 4000 Kg and radius of gyration of one meter loses its speed from 300 rev/min to 240 rev/min in two minutes. Calculate the retarding torque in Nm acting on it, the change in Kinetic Energy and the change in its angular momentum (17)

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