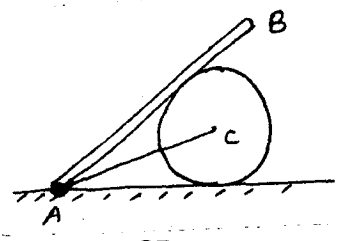
B.Tech Degree I & II Semester Examination in Marine Engineering June 2012

MRE 105 ENGINEERING MECHANICS

Time : 3 Hours Maximum Marks : 100

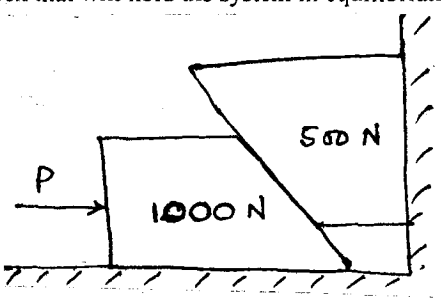
(A) STATICS

I. A smooth right circular cylinder of radius 'r' rests on a horizontal plane and is kept from rolling by an inclined string AC of length '2r'. A prismatic bar AB of length '3r' and weight Q is hinged at point A and leans against the roller as shown. Find the tension that will be induced in the string AC. (16)

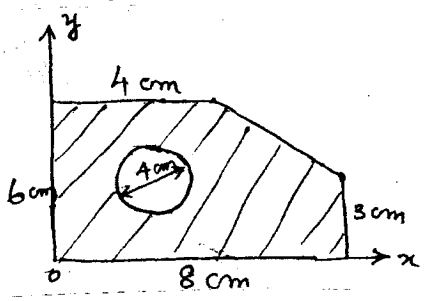


OR

II. Referring to the figure, the coefficient of friction are as follows: 0.25 at the floor, 0.30 at the wall and 0.20 between the blocks. Find the minimum value of a horizontal force P applied to the lower block that will hold the system in equilibrium. (16)

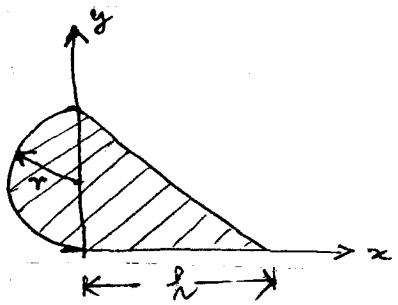


III. Referring to the figure, determine the co-ordinates x_c and y_c of the center of a 4cm diameter circular hole cut in a thin plate so that this point will be the centroid of the remaining shaded area. (17)



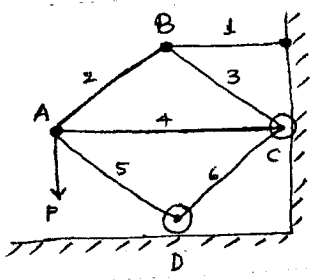
OR

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



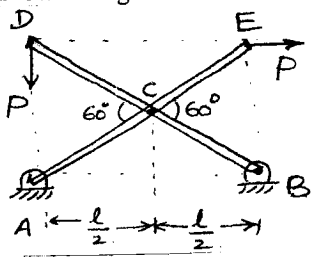
(P.T.O)

V. Determine the axial forces in each of the bars of the truss loaded and supported as shown in figure. ABCD is a square with AC horizontal. (17)



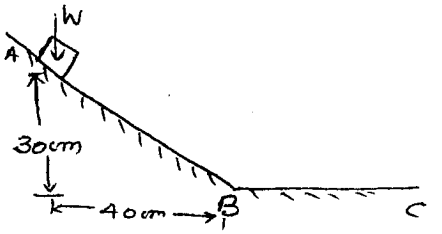
OR

VI. Determine the horizontal and vertical components of reactions at A, B and C of the X-frame loaded and supported as shown in figure. (17)



(B) DYNAMICS

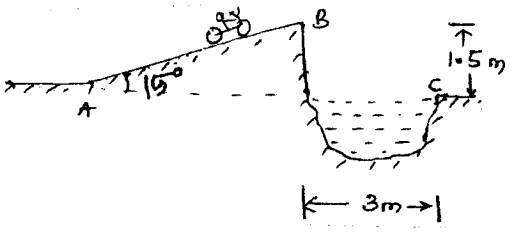
VII. A small block starts from rest at point A, and slides down the enclined plane AB. What distance 's' along the horizontal plane BC will it travel before coming to rest. The coefficient of kinetic friction between the block and the surface is 0.3, Assume that the initial velocity with which it starts to move along BC is of the same magnitude as that gained in sliding from A to B. (16)



OR

VIII. Five men lined up at one end of a floating raft, initially at rest, run in succession with velocity U=3m/s and dives off at the other end. Neglecting resistance of the water to horizontal motion of the raft find its velocity after the last man dives. Each man weighs 800 N and the raft weighs 4500 N. (16)

IX. Referring to figure, calculate the minimum speed v_0 with which the motor cyclist must leave the 15° ramp at B in order to clear the ditch. (17)



OR