

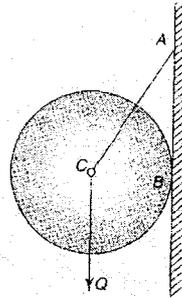
***B.Tech. Degree I & II Semester Supplementary Examination in
Marine Engineering May 2014***

MRE 105 ENGINEERING MECHANICS

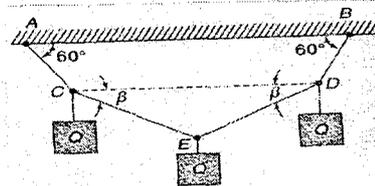
Time : 3 Hours

Maximum Marks : 100

- I. (a) A circular roller of weight $Q = 445\text{N}$ and radius $r = 152\text{ mm}$ hangs by a tie rod $AC = 304\text{mm}$ and rests against a smooth vertical wall as shown in Figure. Determine the tension S in the tie rod and the reaction at B . (7)

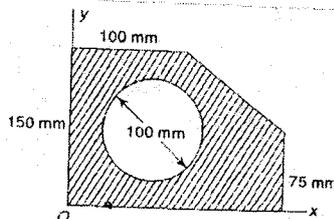


- (b) On the string $ACEDB$ hung three equal weights Q as shown in figure. Determine the value of the angle β if the values of the angles are as shown in figure. (10)

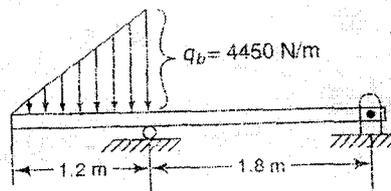


OR

- II. A ladder 6m long weighing 300N is resting against a wall at an angle 60° to the horizontal ground. A man weighing 750N is climbing the ladder. To what position along the ladder from the bottom can he climb without slipping? The coefficients of friction between the ladder and ground and ladder and wall are $\frac{1}{3}$ and $\frac{1}{2}$ respectively. (17)
- III. (a) Referring to figure, determine the coordinates X_c and Y_c of the center of a 100mm diameter circular hole cut in a thin plate so that this part will be the centroid of the remaining shaded area. (10)



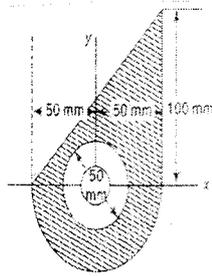
- (b) Compute the reactions at the supports B and C of the beam AC loaded as shown in figure. Neglect the weight of the beam itself. (7)



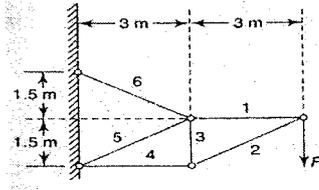
OR

(P.T.O.)

- IV. Calculate the moments of inertia of the composite area show in figure. (17)

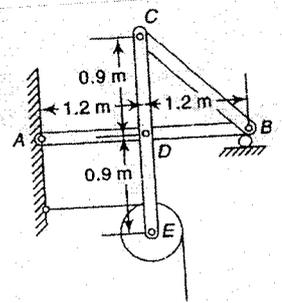


- V. Find out the forces in all members of the truss shown in figure. (17)

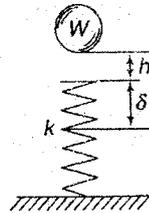


OR

- VI. The frame structure shown in figure supports a load $Q = 5 \text{ kN}$. Assuming ideal pins at all joints find the compressive force s in the bar BC and the shear force R_d on the pin at D. The pulley E has a radius of $r = 0.3 \text{ m}$. (17)

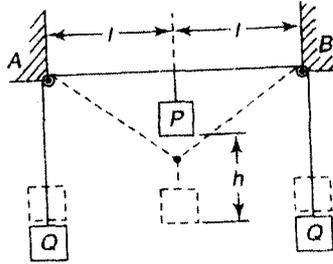


- VII. (a) A stone dropped into a well and falls vertically with constant acceleration $g = 9.81 \text{ m/s}^2$. The sound of the impact of the stone on the bottom of the well is heard 6.55 after it is dropped. If the velocity of the sound is 336 m/s, how deep is the well? (9)
- (b) When a ball of weight W rests on a spring of constant k , it produces a static deflection of 25mm. How much will the same ball compress the spring if it is dropped as shown in figure from a height $h = 0.3 \text{ m}$? Neglect the mass of the spring. (8)



OR

- VIII. (a) 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. (9)

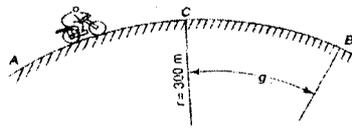


- (b) A ball dropped from a height rebounds twice from the ground and rises to $\frac{1}{4}$ th the height from which it was dropped. Find the coefficient of restitution (8)

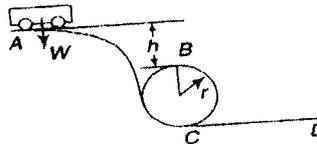
- IX. A soldier fires a bullet with a velocity 31.32 m/s at an angle x upwards from the horizontal from his position on the hill to strike a target 100m away and 50m below his position. Find the angle of projection x . Also find the velocity with which the bullet strikes the object. (16)

OR

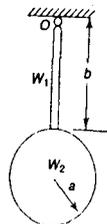
- X. (a) A motorcycle and rider of total weight $W = 2225\text{N}$ travel in a vertical plane with constant speed $V = 72\text{kmph}$ along the circular curve AB of radius $r = 300\text{m}$, as shown in figure. Find the reaction R exerted on the motorcycle by the track as it passes the crest C of the curve. (8)



- (b) A small car of weight W starts from rest at A and rolls with out friction along the loop $ACBD$ as shown in figure. What is the least height h above the top of the loop at which the car can start with out falling of the track at point B and for such a starting position what velocity will the car have along the horizontal position CD of the track? Neglect friction. (8)



- XI. Determine the period of small oscillation of the compound pendulum shown in figure and consisting of a disc suspended by a slender rod if the following numerical data are given: $b = 300\text{mm}$ $a = 125\text{mm}$ $W_1 = 2\text{N}$ $W_2 = 13\text{N}$. (16)



OR

- XII. A slender prismatic bar AB is supported in a horizontal position as shown in figure. At what distance x from the hinge A should the vertical string DE be attached to the bar in order that when it is cut there will be no immediate change in the reaction at A ? (16)

