BT–MRE –I&II–05.19-0860 Reg. No. | | | | | | | | | |

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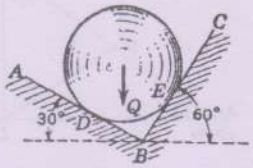
B.Tech. Degree I&II Semester Examination in Marine Engineering May 2019

MRE 1105 ENGINEERING MECHANICS

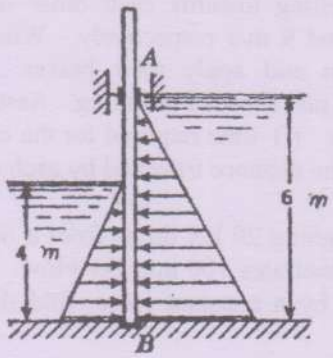
(2013 Scheme)

Time : 3 Hours Maximum Marks : 100

I. (a) A ball of weight Q = 12 N rests in a right angled trough as shown in figure. Determine the forces exerted on the sides of the trough at D and E, if all the surfaces are perfectly smooth. (6)



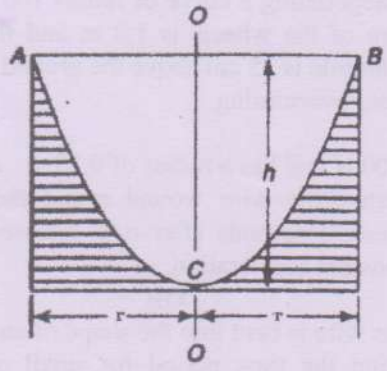
(b) When closed, a vertical sluice gate is supported along the lines AA and BB normal to the plane of the figure and is submitted to the action of water pressure from both sides, as indicated in the figure. If the mass of water per unit volume is 1000 kg/m^3, find the intensities of the reactions developed by the supports in N/m, assuming them to be uniformly distributed along AA and BB. (10)



OR

II. (a) State and prove the 'Theorems of Pappus'. (6)

(b) A right circular cylindrical tank containing water, spins about its vertical geometric axis OO at such speed that the free water surface is a parabaloid ACB as shown in figure. What will be the depth of water in the tank when it comes to rest? (10)

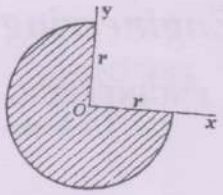


(P.T.O.)

III. Calculate the moment of inertia of a homogenous right circular cone of weight 'W', altitude 'h' and radius of base 'a' with respect to a generator. (17)

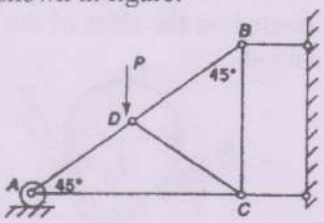
OR

IV. Calculate the product of inertia I_{xy} of the area of a three-quarter circular sector as shown in figure. (17)



V. (a) Explain stable and unstable equilibrium. (5)

(b) Using the principle of virtual work, find the reaction at A for the simple truss supported and loaded as shown in figure. (12)



OR

VI. (a) What are the laws of friction? (5)

(b) The efficiency of a screw jack is 55%, when a load of 1500 N is lifted by an effort applied at the end of a handle of length 50 cm. Determine the effort applied if the pitch of the screw thread is 1 cm. (12)

VII. Two cars are travelling towards each other on a single lane road at the velocities 12 m/s and 9 m/s respectively. When 100 m apart, both drivers realise the situation and apply their brakes. They succeed in stopping simultaneously and just short of colliding. Assume constant deceleration for each case, determine (i) time required for the cars to stop (ii) deceleration of each car (iii) the distance travelled by each car while showing down. (16)

OR

VIII. A pile hammer weighing 20 kN drops from a height of 750 mm on a pile of 10 kN. The pile penetrates 100 mm per blow. Assuming that the motion of the pile is resisted by a constant force, find the resistance to penetrate the ground. (16)

IX. A soldier fires a bullet with a velocity of 31.32 m/s at an angle α upwards from the horizontal from his position on a hill to strike a target which is 100 m away and 50 m below his position. Find the angle of projection α. Also find the velocity with which the bullet strikes the object. (17)

OR

X. An automobile is negotiating a curve of radius 100 m. The distance between the centre to centre of the wheels is 1.2 m and the height of the centre of gravity of the automobile is 75 cm above the ground. Determine the maximum speed in m/s to avoid overturning. (17)

XI. A pulley weighs 500 N and has a radius of 0.75 m. A block weighing 400 N is supported by inextensible wire wound round the pulley. Determine the velocity of the block 2 seconds after it is released from rest. Assume the motion is under constant acceleration. (17)

OR

XII. A thin homogenous wire is bent into the shape of an equilateral triangle of side a = 250 mm. Find the time period for small oscillations, if the wire is suspended from a pin at the vertex of the equilateral triangle. What will be the time period if the wire is suspended from a pin located at the midpoint of a side? (17)

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