

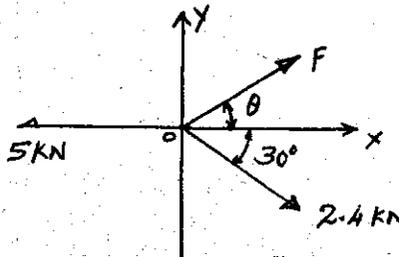
B. Tech Degree I & II Semester Examination in Marine Engineering, May 2008

MRE 105 ENGINEERING MECHANICS

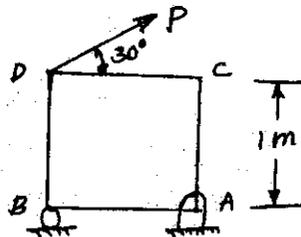
Time : 3 Hours

Maximum Marks : 100

- I. (a) The force system shown in figure, has a resultant of 2 kN pointing up along Y axis. Compute the value of F and θ required to give this result. (8)

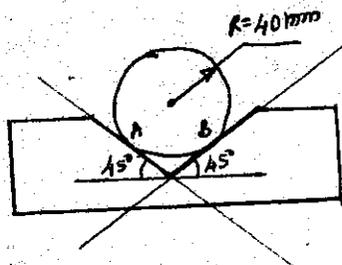


- (b) A square block of wood of mass 1000 N is hinged at A and rests on a roller at B. It is pulled by means of a string attached at D and inclined at an angle 30° with the horizontal. Determine the force P which should be applied to the string to just lift the block off the roller. Side of the block is 1 m. (9)



OR

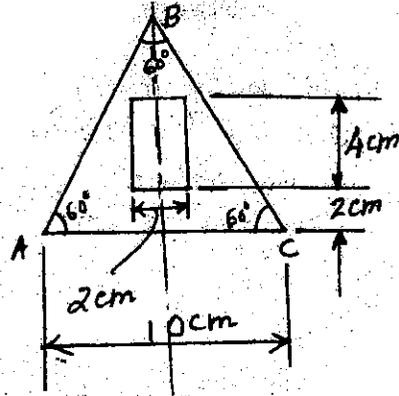
- II. (a) Define the angle and cone of friction. (6)
- (b) A cylinder is resting on a V-block as shown in figure. It weighs 25 N. The coefficients of friction at surfaces A and B are 0.15 and 0.25.
- (i) What is the minimum force required to cause impending sliding motion of the cylinder perpendicular to the plane of the paper?
- (ii) What is the minimum value of torque required to cause impending angular motion (sliding) of cylinder in the clockwise sense? (11)



- III. (a) Derive an equation for the polar moment of inertia of a Hollow circular section. (5)

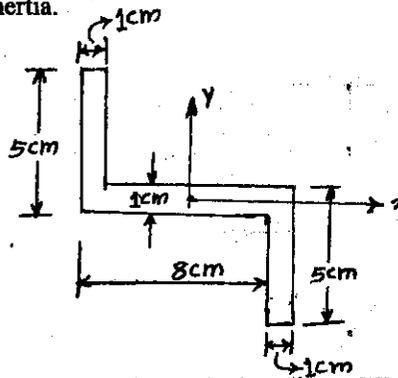
(Turn Over)

- (b) Find the moment of inertia of a triangular section as shown in figure below about X-X axis passing through the centroid. (12)

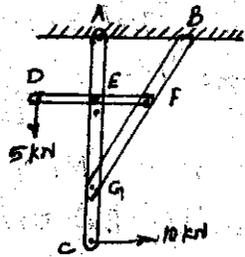


OR

- IV. Find the product of inertia of the area shown with respect to the centroidal x and y axes. Also find the angle θ defining the directions of principal axes through the centroid and the principal moments of inertia. (17)

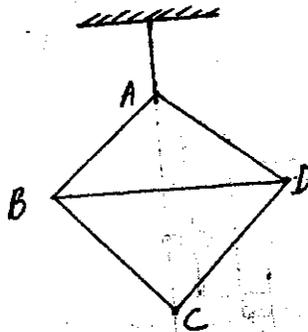


- V. (a) What are the assumptions made in the analysis of planar trusses by the method of joints? (5)
 (b) A frame shown in figure below is supported and loaded as indicated. The distance AE, EG, GC, DE and EF are equal to 5 m. AB = 10 m. Find the rectangular components of shear forces acting on pins E, F and G. Neglect friction. (12)

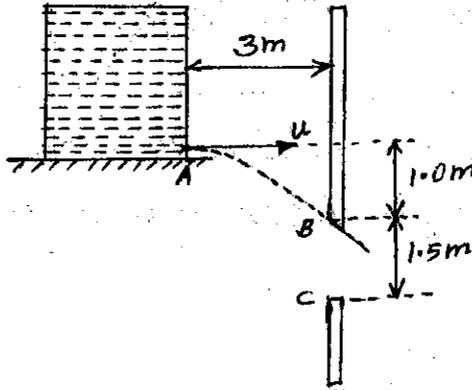


OR

- VI. (a) Explain the principle of virtual work. (5)
 (b) FOUR rods AB, BC, CD and DA each of length '2a' and equal in cross-section are pin joined to form a square frame ABCD. The frame ABCD has the fifth rod BD as horizontal diagonal. The frame is suspended from the topmost joint A as shown in figure. If the weight of each rod is W, find the thrust in the rod BD using the principle of virtual work. (12)

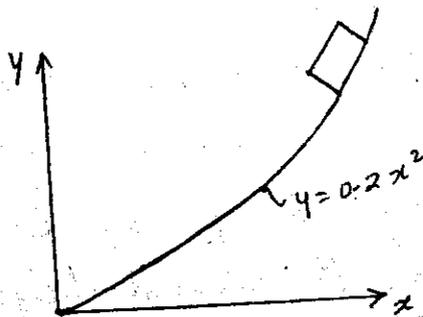


- VII. (a) Two cars start from the same place and move on the roads at right angles to one another. One moves with uniform velocity of 5 m/s while the other starts from rest and moves with uniform acceleration. If after 10 seconds the distance between two cars is 120 m, determine the acceleration of the second car and distance traveled by it. (9)
- (b) A particle of Mass 'M' falls vertically from rest in a medium whose resistance is proportional to the velocity. Determine the velocity of the particle after a time 't'. (8)
- OR**
- VIII. (a) Two men, M_1 of mass 50 Kg and M_2 of mass 75 Kg, dive off the end of a boat of mass $M = 250$ Kg so that their relative velocity with respect to the boat is 4 m/s. If the boat is initially at rest, find its final velocity if (i) two men dive simultaneously (ii) the man of mass 75 Kg dives first followed by the man of mass 50 Kg. (7)
- (b) A ball of mass m is dropped on to a spring of stiffness 'K' from a height 'h'. Find the maximum deflection ' δ ' of the spring by the principle of conservation of energy. Assume $m = 5$ Kg, $K = 500$ N/m, $h = 10$ cm. (10)
- IX. (a) A particle is projected with a given velocity ' u ' at an angle of elevation ' α ' from the origin. It passes through two points (15, 8) and (40, 9) on its path. Find the greatest height reached by the particle and its range. (8)
- (b) A pressure tank issues water at A with a horizontal velocity ' u ' as shown in figure. For what range of values of ' u ' will water enter the opening BC. (8)



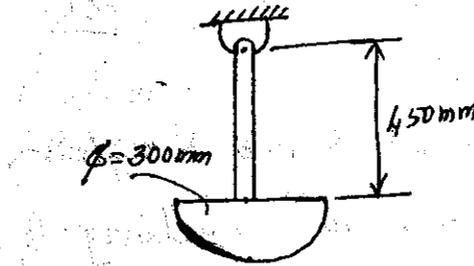
OR

- X. (a) A bob weighing 1N suspended by a cord from the ceiling of a railway carriage was found to make an angle $\theta = 8^\circ$ with the vertical when the railway carriage was negotiating a curve of 100 m. Find the speed of the carriage and the tension in the cord. (7)
- (b) A block of mass 180 Kg slides down a smooth curved path defined by the equation $y = 0.2x^2$, as shown in figure. At $x = 10$ m, velocity of the block is 5 m/s. At this instant what is the reaction of the curved surface on the block and what is the acceleration of the block? (9)



(Contd.....4)

- XI. (a) How would you locate the centre of oscillation in a compound pendulum. (5)
 (b) Find the length of the equivalent simple pendulum of the compound pendulum consisting of a uniform semicircular disc of diameter 300 mm and weighing 15 N attached to a slender rod of length 450 mm and weight 5 N as shown in figure. (11)



OR

- XII. (a) A rotor having moment of inertia 'I' with respect to its axis of rotation starts from rest and is brought up to an angular velocity θ° by a constant driving torque M. Develop formulas for the time 't' required to reach this speed and for the total angular displacement. (8)
- (b) A grinding wheel has a rated speed of 1500 rpm and can be assumed to be a disc of 0.5 m radius and of uniform thickness. It weighs 300 N. It is made to turn at 1500 rpm and then allowed to decelerate uniformly due to bearing friction. It was observed to come to rest in 120 seconds. Determine --
- the number of revolutions that it shall execute before coming to rest
 - the frictional torque. (8)

