

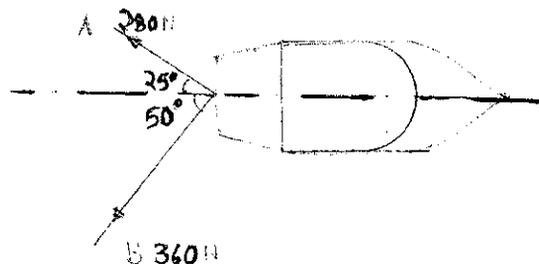
B. Tech Degree I & II Semester Examination in Marine Engineering, May 2009

MRE 105 ENGINEERING MECHANICS

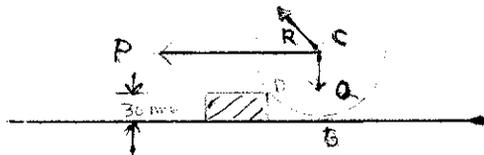
Time : 3 Hours

Maximum Marks : 100

- I. (a) Two water skiers are being pulled by a boat as shown in figure. If the force in tow rope 'A' is 280 N and the force in tow rope 'B' is 360 N find the resultant force that the two ropes exert on the boat. (8)



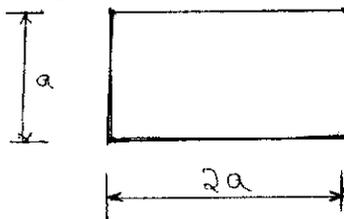
- (b) Determine the magnitude of a horizontal force P applied at the centre 'C' of a roller of weight $Q = 1000\text{ N}$ and radius ' $R = 150\text{ mm}$ ' which will be necessary to pull it over a 30 mm curb? (9)



OR

- II. (a) A mass of 50 Kg is pulled up a rough inclined plane whose inclination to the horizontal is 30° by a force of 350 N acting parallel to the plane. Find the coefficient of friction. (8)
- (b) A turn buckle has right and left handed square thread of 4 mm pitch, mean diameter 32 mm, $\mu = 0.12$. The turn buckle is used to tighten a wire rope under tension of 12 kN calculate the turning moment required. (9)

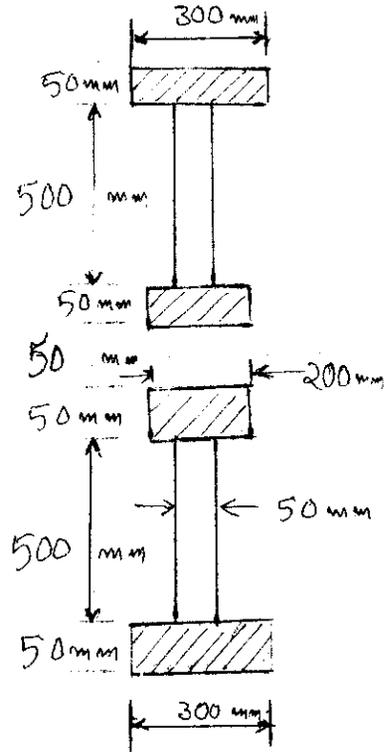
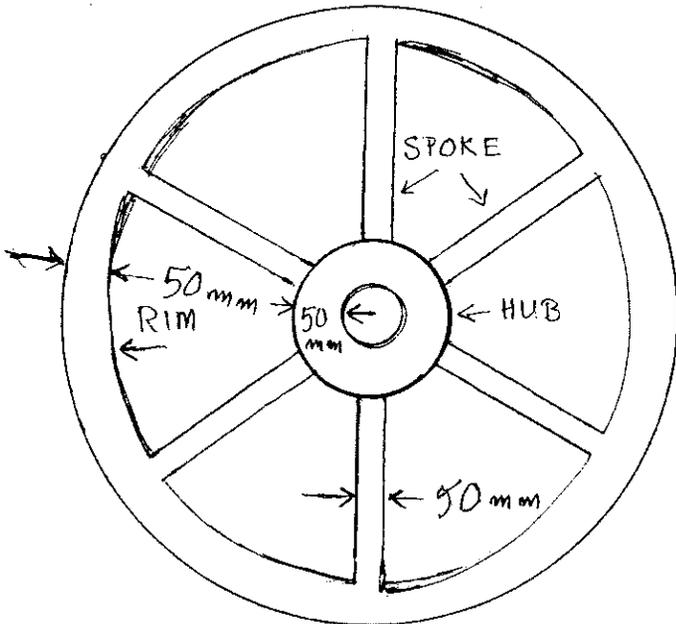
- III. Determine the polar moment of inertia of the rectangle shown in figure with respect to the mid points of (i) its longer side and (ii) its shorter side. (16)



OR

(Turn Over)

IV.



Determine the mass moment of inertia of the Flywheel shown about its central axis of rotation. The spokes have circular cross section. It is made up of steel with density = 7850 Kg/m^3

(16)

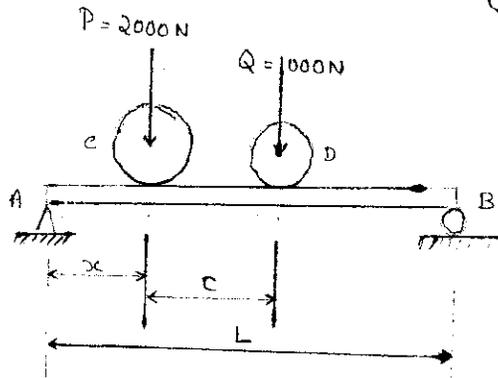
V.

(a) Explain the principal of virtual work.

(8)

(b) Two rollers C & D produce vertical forces P & 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 $P = 2000 \text{ N}$ $L = 12 \text{ m}$

$Q = 1000 \text{ N}$ $C = 3 \text{ m}$ (9)

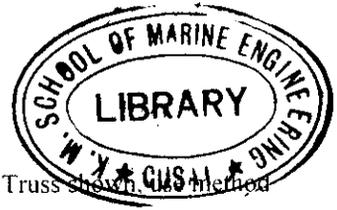


OR

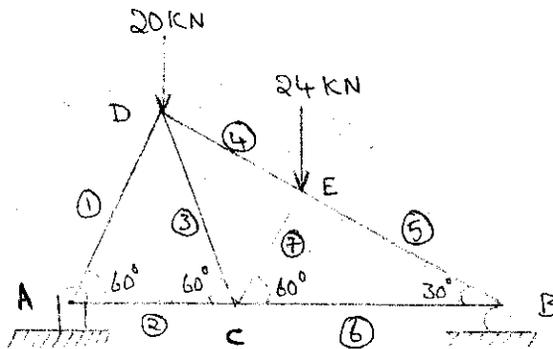
VI. (a) Differentiate between Method of Joints and Method of Sections in the Analysis of Trusses.

(8)

(Contd.....3)



- (b) Find the reactions and forces in members 4, 6 and 7 of the Truss shown in the Method of sections. (9)



AB = 5 m
 AD = 2.5 m
 BD = 4.33 m
 BE = 2.165 m
 CE = 1.25 m

- VII. (a) A bullet of mass 1.8 gram travelling at 400 m/s hits a fixed target and penetrates it by 120 mm. Calculate the retarding force in Newton's. assuming it to be uniform and the time taken for the penetration. (8)
- (b) A motor car of mass 1000 Kg starts from rest to move along a straight road. Its speed in kilometers per hour at intervals of 5 sec is recorded as

t	0	5	10	15	20	25	30
v	0	10	21	36	52.8	72	96

Estimate the distance traveled at the end of 30 seconds also calculate the net effective force exerted by its engine at the time. (9)

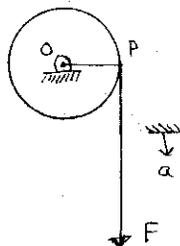
OR

- VIII. (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) A mass of 10 tonnes is being hauled up an incline of 1 in 80 by means of a wire rope. The frictional resistance is 200 N per tonne. At a certain instant, the velocity of the rope is 12 Km/hr and the acceleration up the plane is 0.5 m/s². Find the tension in the wire rope and the power exerted on it at that instant. (9)

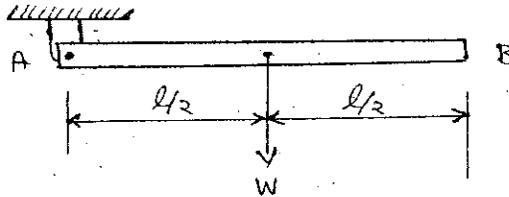
- IX. A flywheel of mass 4000 Kg and radius of gyration of one meter loses its speed from 300 rev/min to 240 rev/min in two minutes. Calculate the retarding torque in Nm acting on it, the change in Kinetic Energy and the change in its angular momentum. (16)

OR

- X. A cord is wrapped around a wheel of radius 0.2 m initially at rest. If a force is applied to the cord and gives it an acceleration 'a' = 4 t m/s², where 't' is the time in second. Determine the angular velocity and angle of line OP as a function of time. (16)



- XI. If a slender prismatic bar AB is released from rest in the horizontal position and rotates about 'A' under the influence of gravity, find the reaction at A as it swings through the vertical position. (17)



OR

- XII. A disc weight ' w ' = 100 N and radius r = 0.25 m supported at its centre is acted upon by a constant couple of moment 6 Nm and a force of 50 N is applied to a cord wrapped around its periphery. Determine the angular velocity of the disc two seconds after starting from rest. (17)

