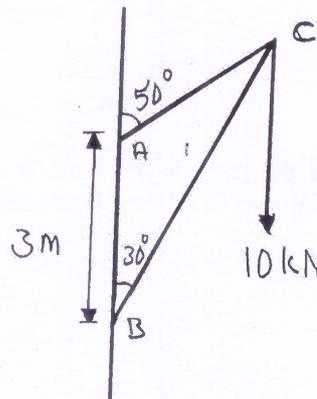# B.Tech. Degree I & II Semester Supplementary Examination in Marine Engineering May 2017

MRE 105 ENGINEERING MECHANICS
(*Prior to 2013 Scheme*)

Time: 3 Hours   Maximum Marks: 100

I. (a) A Jib crane shown in figure is required to lift a load of 10 kN. Find the forces   (6)
   in the Jib and tie.

   (b) A uniform wheel 70 cm diameter and weighing 750 N rests against a   (10)
        rectangular block 20 cm high lying on a horizontal plane as shown in figure.
        It is to be pulled over this block by a horizontal force '*P*' applied to the end of
        the string wound round the circumference of the wheel. Find the force '*P*'
   when the wheel is just above to roll over the block.
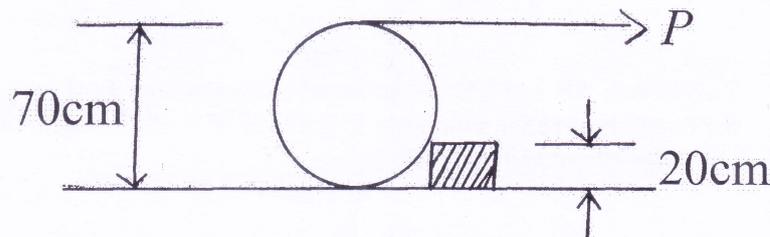
OR

II. (a) Prove that the power lost due to friction in a conical pivot is $\dfrac{2\pi NT}{60}$.   (6)

    (b) In a collar thrust bearing the external and internal radii are 250 mm and   (10)
         150 mm respectively. The total axial load is 50 kN and the shaft rotates at
         150 rpm. The coefficient of friction is 0.05. Find the power lost in friction
         assuming uniform pressure condition.

III. (a) What is Polar Moment of Inertia?   (6)
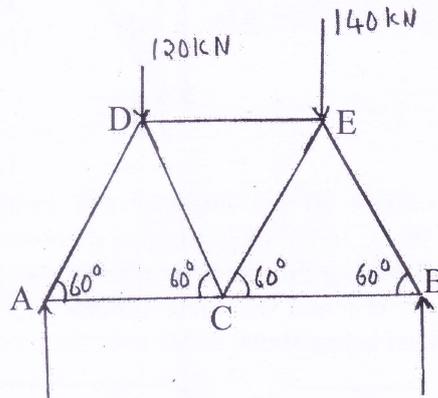   (b) Find centroid of the composite figure shown.   (11)

OR
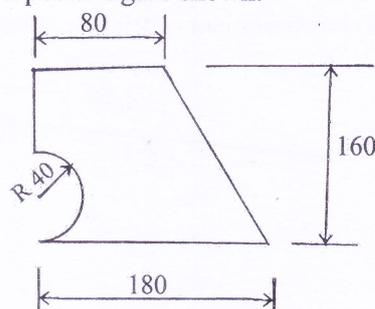
IV.   (a)   Define (i) Product of Inertia, (ii) Radius of Gyration.   (6)

     (b)   Find out moment of Inertia of the given area with respect to the centroidal   (11) horizontal axis.
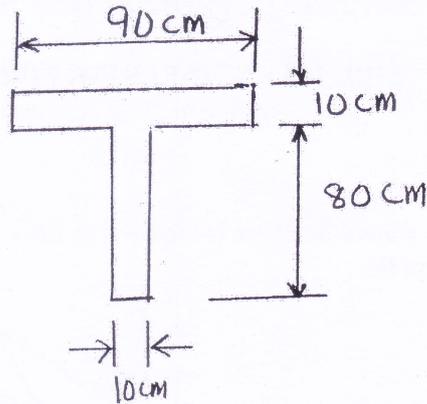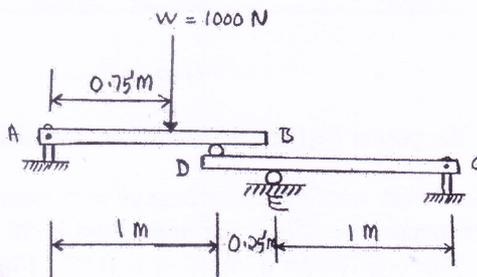

V.   Each member of the truss is 2m long. It is simply supported and loaded as   (17) shown. Find the forces in all members and nature of force.


OR

VI.   Two beams AB and CD are arranged and supported as shown in figure. Find   (17) the reaction of roller support at E if a load W = 1000 N acts on AB as shown. Use principle of virtual work.


VII.   (a)   Derive expression for velocity and acceleration of a particle performing SHM.   (6)

     (b)   Two bodies are connected over a frictionless pulley with an inextensible   (10) string as shown in figure. Determine acceleration of the system and tension in the string. Take coefficient of friction between body and incline as 0.25.
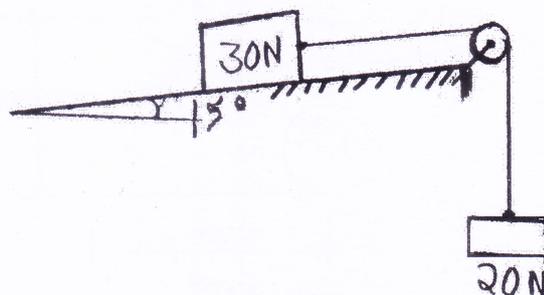
OR

VIII. (a) A ball of 0.5 N weight falls from a height of 15 m and rebounds to 10 m. (6) Find the impulse and average force between the ball and floor, if the time during which they are in contact is $\frac{1}{12}^{th}$ of a second.

(b) A bullet of mass 30 gm is fired horizontally to a body of mass 10 kg which is (10) suspended by a string of 0.8 m long. Due to this impact, the body swings through an angle of 30°. Find the velocity of the bullet.

IX. (a) Write notes on 'Angular Momentum'. (6)

(b) An automobile of weight 'W' travels with uniform speed v = 100 km/hr over (11) a bridge ABC of parabolic shape as shown. Determine the total pressure exerted by the wheels of the car as it passes the point B.
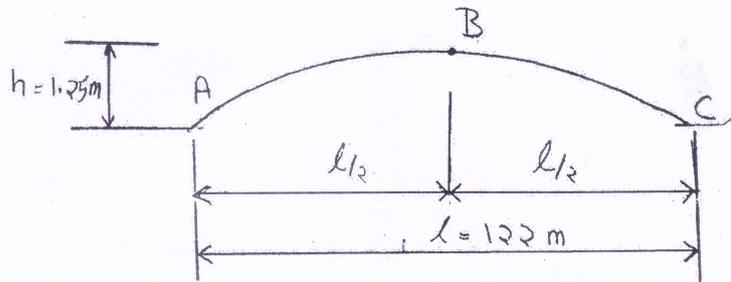
OR

X (a) Derive an equation for the path of a projectile. (6)

(b) Two adjacent guns having the same muzzle velocity of 450 m/s, fires (11) simultaneously at angle of θ_1 and θ_2 for the same target situated at a range of 5000 m. Find the time difference between the two hits.

XI. A cylinder of mass 'm' and radius 'r' rolls down an inclined plane without (17) sliding due to the action of gravity. The inclination of the plane with horizontal is given by angle θ. Determine:

(i) The acceleration of the centre of gravity of the cylinder down the plane.

(ii) The maximum inclination θ of the inclined plane for which the cylinder will roll without sliding, if the coefficient of friction at the point of contact is 'μ'.

OR

XII. Two weights, 108 N and 156 N are suspended from a compound pulley as (17) shown in figure. Find:

(i) Angular acceleration of the pulley.

(ii) Linear acceleration of W_1 and W_2.

(iii) Tension in the strings.

Take weight of the pulley as 350 N and radius of gyration 0.25 m.

$r_1 = 0.2m$
$r_2 = 0.3m$

$W_1 = 108N$
$W_2 = 156N$

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