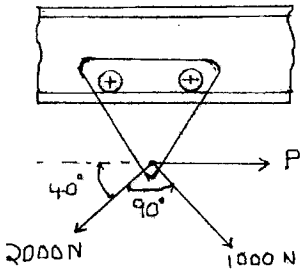
B.Tech. Degree I & II Semester Examination in Marine Engineering May 2013

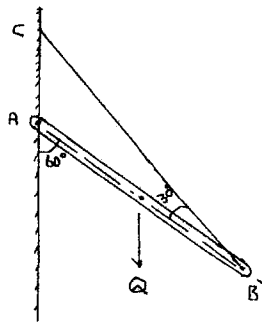
MRE 105 ENGINEERING MECHANICS

Time : 3 Hours Maximum Marks : 100

I. (a) Three forces are acting on a hoist trolley as shown in the figure. If the resultant of these force system is vertical, find 'P' and magnitude of the resultant force. (7)



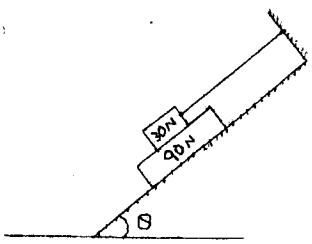
(b) A prismatic bar AB of weight Q = 2 tons is hinged to a vertical wall at A supported at B, by a cable BC. Determine the magnitude and direction of resultant at the hinge and tension in the cable. (10)



OR

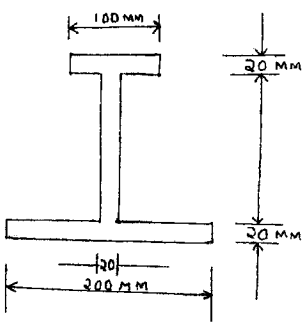
II. (a) Find the power lost in friction assuming (i) uniform pressure and (ii) uniform wear when a vertical shaft of 100mm diameter rotating at 150 rpm rests on a flat end foot step bearing. The co-efficient of friction is 0.05 and shaft carries a vertical load of 15 KN. (8)

(b) What should be the value of angle θ in the figure so that the motion of the 90N block impends down the plane? The co-efficient of friction μ for all the surfaces is 1/3. (9)



III. (a) Derive equation for mass moment of inertia of a rectangular plate about a line passing through the base. (7)

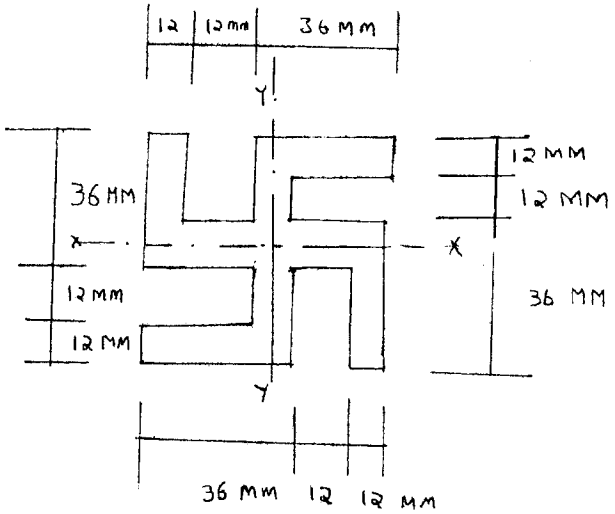
(b) Find the moment of inertia of the section shown in the figure about its centroidal axis. (10)



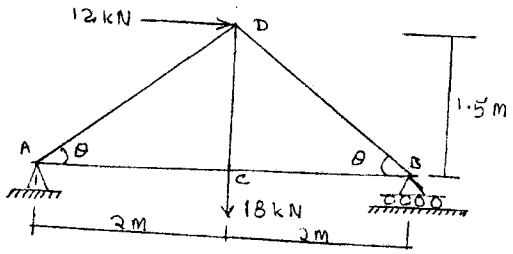
OR

IV. (a) Determine the position of centroid of a quarter circular lamina of radius 'a'. (7)

(b) Compute moment of inertia about X-X and Y-Y axis and hence calculate polar moment of inertia of the figure of "Holy mark of Swastika". (10)



V. Determine the forces in the truss shown in the figure which carries a horizontal load of 12KN and a vertical load of 18KN. (17)



OR

VI. Five rods AB, BC, CD, DA and BD each of equal length and equal cross section are pin jointed together so as to form a plane frame ABCD. The frame ABCD has a rhombus shape with one horizontal diagonal BD. The frame is suspended from the top most joint A. A weight 'W' is attached at the lower most joint C. Neglecting the self weight of the frame and using the method of vertical work, find the magnitude of thrust in the member BD. (17)

VII. In a mechanism a cross-head moves in a straight guide with simple harmonic motion. At a distance of 125mm and 200mm from the mean position, it has velocities of 6 m/s. and 3 m/s respectively. Find the amplitude, maximum velocities and period of vibration. If the cross head weights 0.2 kg, calculate the maximum force on it in the direction of motion. (17)

OR

VIII. A car of weight 9810N accelerates from rest to a speed of 45km/hr in a distance of 50m against a resistance of 100N. Find the average driving force acting on the car. Using the average force, find the greatest power developed by the engine. (17)

IX. A wheel rotating about a fixed axis at 20 rpm, is uniformly accelerated for 70s, during which time it makes 50 revolutions. Find (i) angular velocity at the end of this interval and (ii) time required for the speed to reach 100 revolution per minute. (16)

OR

X. A fly wheel is rotating at 200 rpm and after 10 seconds it is rotating at 160 rpm. If the retardation is uniform, determine number of revolutions made by fly wheel and the time taken by the fly wheel before it comes to rest from the speed of 200 rpm. (16)

XI. A point moves along a path $y = \frac{x^2}{3}$ with a constant speed of 8m/s. What are the x and y components of its velocity where x = 3m. What is the acceleration at this point? (16)

OR

XII. A homogenous circular disc of radius 'r' and weight 'w' hangs in a vertical plane from a pin 'o' at the circumference. Find the period for small angles of swing in the plane of the disc. (16)

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