B.Tech Degree I & II Semester Examination in Marine Engineering June 2010
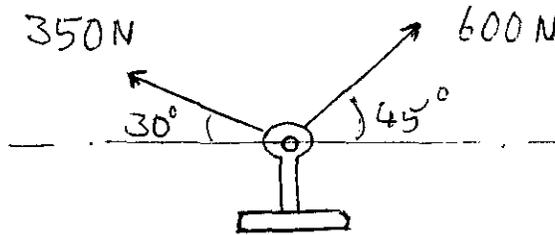
MRE 105 ENGINEERING MECHANICS
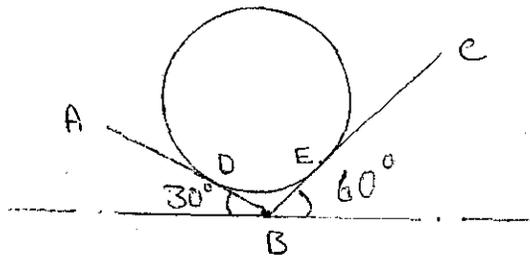
Time : 3 Hours   Maximum Marks : 100

I.   (a)   Two forces are applied to an eye as shown in the figure. What is the resultant force?   (7)

   (b)   A ball of weight 12N rests in a right angled Trough as shown. Determine the force exerted   (10)
on the sides of the Trough at D and E if the surfaces are perfectly smooth.

OR

II. (a)   The thrust shaft of a ship has 6 collars of 600 mm external diameter and 300mm internal   (8)
diameter. The total thrust from the propeller is 100kN and the speed of the engine is 90
rev/min. Determine the power lost in friction at the thrust block assuming
   (i)   Uniform pressure
   (ii)   Uniform wear
If μk is constant and is equal to 0.12.

   (b)   A body is resting on a rough horizontal surface requires a pull of 18N inclined at 30^0 to the   (9)
plane of the surface just to move it. It was found that a push of 22N inclined at 30^0 to the
plane just move the body. Determine the weight of the body and coefficient of friction
between the surface and body?

III. (a)   Locate the centre of gravity of the area shown in the figure. All dimensions in mm.   (9)
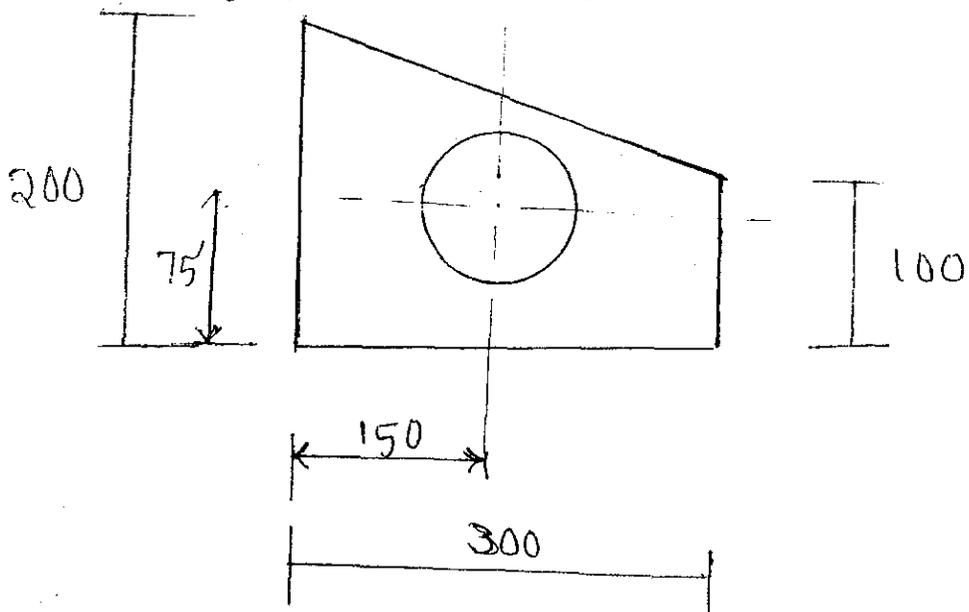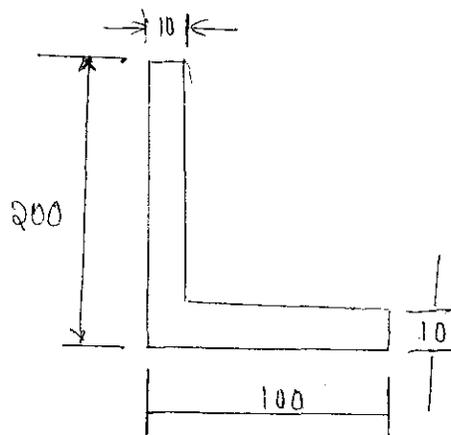
(b) Determine the Second Moment of a Semi-circular area of a radius 'r' with respect to   (8)
  (i)   The axis of symmetry of the area
  (ii) An axis tangent to the semi-circle and parallel to the axis symmetry.

OR

IV. (a) Determine the product of inertia of the area given about x_0 y_0 centroidal axis.   (8)
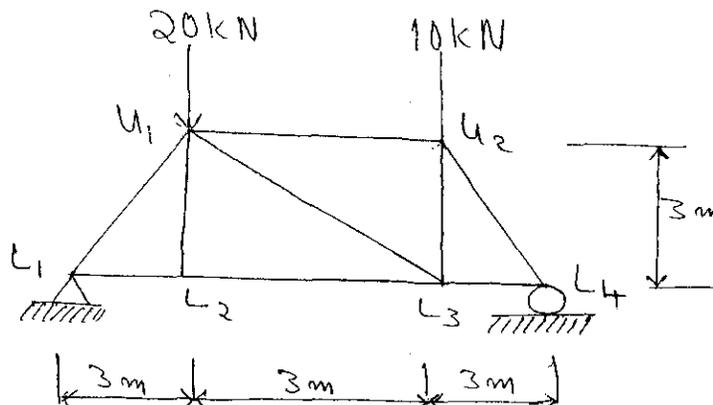

All dimensions in mm
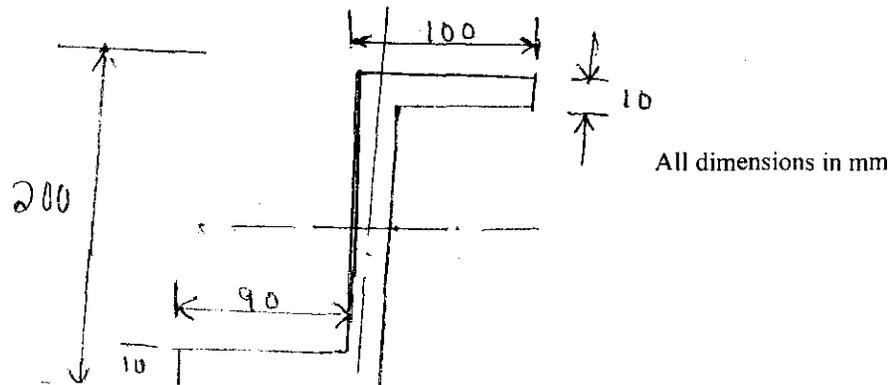
(b)

(9)

Determine $\bar{I}_x, \bar{I}_y$ and $\bar{I}_z$ and also $\bar{K}_x, \bar{K}_y$ and $\bar{K}_z$ for the angle. Section given. All dimensions are in mm.

V.

(17)

find out the forces in all members at the truss by using the method of joints.

OR

VI. A beam ABCDE 10 meter long is hinged at 'A; and freely supported at B and D. AB = 2m;   (17)
BD = 6m; the over hung DE = 2m. There is a hinge at 'C' mid way between B and D. The
loading consist of a point load of 15 kN at the free end E, 20kN at the middle of BC and
40kN at the middle of CD. Evaluate the reactions at the support using principle of virtual
work.

VII A particle has a velocity of 5 m/s and it is showing down in such a manner that the relation (17) between 'V' and 't' in meter-second unit is given by

$$V = 5 - t - \frac{1}{6}t^3$$

Calculate the average retardation, average velocity and distance traveled in first two seconds.

OR

VIII. The piston of a steam engine moves with simple harmonic motion. The crank rotates at 120 (17) rpm and stroke length is 2 meters. Find the velocity and acceleration of the piston, when it is at a distance of 0.75 meters from the centre.

IX. The horizontal range of a bullet when fired at an elevation f 45^0 is 1200 meters. Show that (16) if the bullet is fired with the same velocity and at the same elevation from a lorry moving at 24km/hr, towards the target, the range will be increased by 106 meters. Take g = 9.8m/s^2.

OR

X. A 3 Kg mass is attached at the end of a cord 1m long and whirled in the vertical plane. (16) Determine the maximum and minimum tensions in the cord at 2 rev/second. What is the speed at which the tension just disappear in the cord?

XI. Develop a formula for the period 'T' for small oscillation of the compound pendulum as (16) shown in the figure. AB and OD are identical slender bars of uniform cross section.
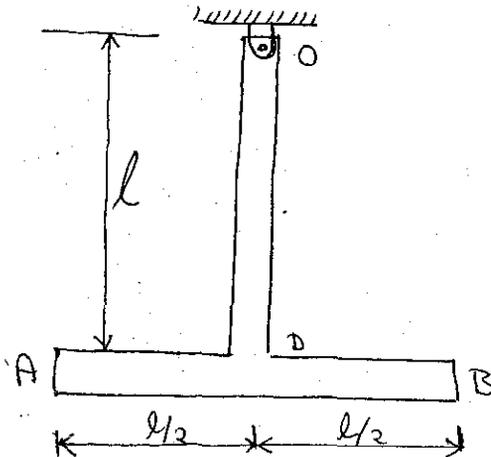
OR

XII. A homogeneous slender prismatic bar AB of length 1m and weight 100N is hinged at its (16) lower end and can rotate freely in the vertical plane as shown. If the bar is released from rest in the unstable position and falls under the influence of gravity, calculate the components of reactions at 'A' when $\theta = 30^0$.

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