B.Tech. Degree I &II Semester Examination in Marine Engineering May 2018

MRE 1105 ENGINEERING MECHANICS
(2013 Scheme)

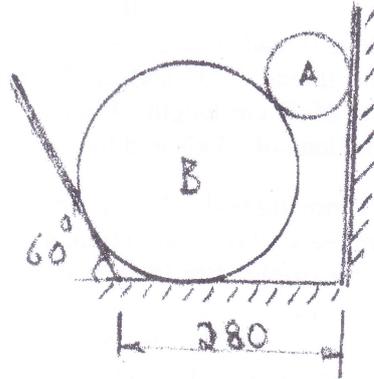Time: 3 Hours   Maximum Marks: 100

I.   (16)

Two cylinders A and B rest in a channel as shown in figure. The cylinder A has diameter of 100 mm and weight 200 N where as the cylinder B has diameter 280 mm and weight 1500 N. If the bottom width of the channel is 280 mm with one side vertical and the other side inclined at 60°, determine reactions at all contact surfaces.
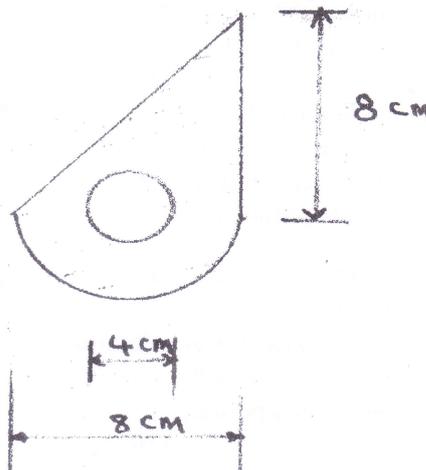
OR

II.   A square hole is punched out of circular lamina, the diagonal of the square is   (16)
the radius of the circle. If the diameter of the circular lamina is 'd', prove

that the centroid of the remainder is at a distance of $\left(\dfrac{d}{8\pi - 4}\right)$ from the centre
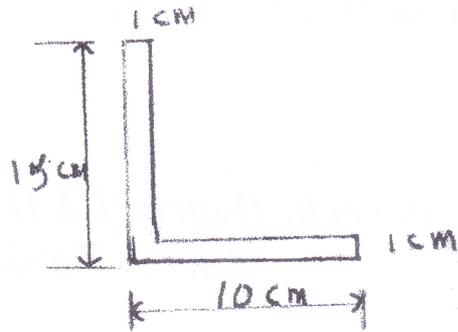
of the circle.

III.   Determine moment of inertia of the section shown in figure about its   (17)
centroidal axes.

OR

IV.   For the unequal angle section shown in figure, determine the location of principal axes.   (17)

V.   In a simple wheel and axle mechanism, the diameter of wheel and axle are 50 cm and 25 cm respectively. The weight of the wheel and axle is 4 kN and is mounted on a shaft of 5 cm in diameter. Coefficient of friction between the shaft and bearing is 0.1. Determine: (i) Velocity ratio (ii) Effort required to raise a load of 10 kN.   (17)

OR

VI.   A screw jack of square threaded screw is of 8 cm mean diameter. The angle of inclination of the thread is 3° and coefficient of friction is 0.1. It is operated by a handle of 50 cm length. Find the force required at the end of the handle to raise the load of 15 kN and the same load to be brought down.   (17)

VII.   The acceleration of a moving body along a straight line is given by $a = 2 - 3t$. After 5 seconds from the start of observation, its velocity is 20 m/s. The body travelled 85 m from the origin after 10 seconds of start of observation. Determine (i) Its acceleration, velocity and distance travelled from the origin at the start of observation (ii) The time after start of observation in which the velocity become zero, and its distance from the origin.   (16)

OR

VIII.   (16)
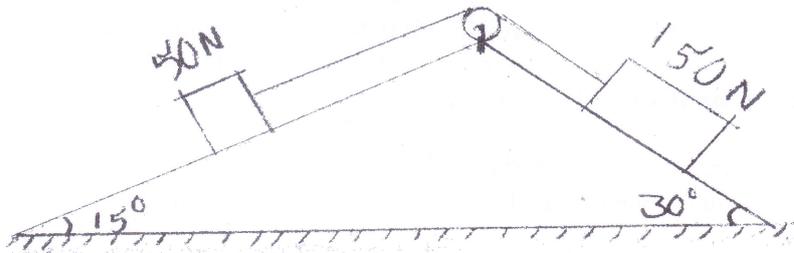
A connected system is shown in figure. If the coefficient of friction between the bodies and planes is same and equal to 0.3, find
    (i) Acceleration of the system.
    (ii) Tension in the string.

IX.   A particle thrown from a horizontal plane comes back to the plane in 4 seconds at a distance of 60 m from the point of projection. Find the velocity of projection. Take 'g' as 9.8 m/s^2.   (17)

OR

X.   An automobile enters a curved road at 30 km/hr and leaves at 48 km/hr. The curved road is in the form of a quarter circle and has a length of 400 m. If the car travels at constant acceleration along the curve, calculate the resultant acceleration at both ends of the curve.   (17)

XI.   A fly wheel has an initial angular speed of 3000 rpm in clockwise direction. When a constant turning moment was applied to the wheel, it got subjected to a uniform anticlockwise angular acceleration of 3 rev/sec^2. Determine the angular velocity of the wheel after 20 seconds, and the total number of revolutions made during this period.   (17)

OR

XII. (a) State and explain principle of angular momentum in rotation.   (5)
      (b) A fly wheel of 1000 kg mass and 0.8 m radius of gyration is rotating at 180 rpm. Determine its kinetic energy. Also determine the torque required to give the wheel a speed of 300 rpm in 20 seconds.   (12)

***