C

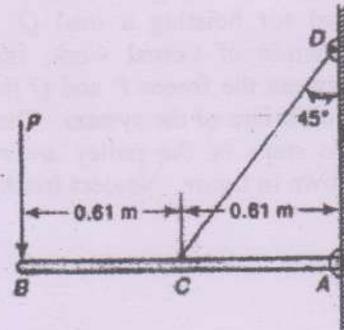# B.Tech. Degree I & II Semester Supplementary Examination in Marine Engineering May 2019

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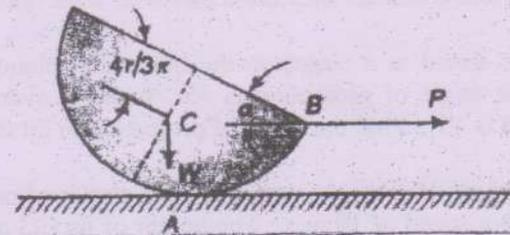*(Prior to 2013 Scheme)*

Time: 3 Hours
Maximum Marks: 100

I. A horizontal beam AB is hinged to a vertical wall at A and supported at its midpoint C by a tie rod CD as shown in figure. Find the tension in the tie rod and the reaction at A due to a vertical load P applied at B.   (16)
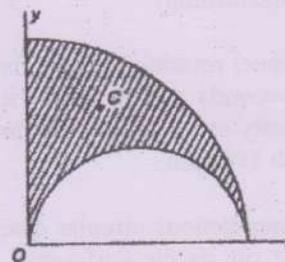
OR

II. A short semi circular right cylinder of radius r and weight W rests on a horizontal surface and is pulled at right angles to its geometric axis by a horizontal force P applied at the middle B of the front edge. Find the angle α that the flat face will make with the horizontal plane just before sliding begins if the coefficient of friction at the line contact A is μ. The gravity force W must be considered as acting at the centre of gravity C as shown in figure.   (16)

III. Locate the centroid C of the shaded area obtained by cutting a semi circle of diameter 'a' from the quadrant of a circle of radius 'a' as shown in figure.   (17)
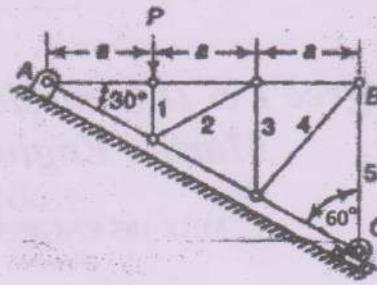
OR

IV. Determine the moment of inertia of a homogeneous regular hexagonal lamina having weight W and sides of length a with respect to a diagonal.   (17)

(P.T.O.)

V   Determine the axial forces in the bars 1, 2, 3, 4 and 5 of the plane truss supported and loaded as shown in figure.   (17)
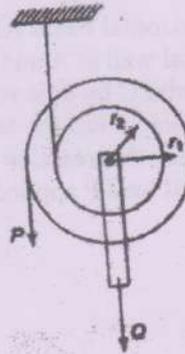

OR

VI.   The pulley arrangement shown in figure is used for hoisting a load Q. Using the principle of virtual work, find the ratio between the forces P and Q in the case of equilibrium of the system. The radii of the two steps of the pulley are r_1 and r_2 as shown in figure. Neglect friction.   (17)

VII.   A particle is performing a simple harmonic motion. When it is at distances of 10 cm and 20 cm from the mean position its velocities are 1.2 m/s and 0.8 m/s respectively. Find (i) the amplitude of oscillation, (ii) time period of oscillations (iii) its maximum velocity and acceleration.   (16)

OR

VIII.   A ball is dropped from the top of a tower 30 m high. At the same instant a second ball is thrown upwards from the ground with an initial velocity of 15 m/s. When and where do they cross and with what relative velocity?   (16)

IX.   A projectile is aimed at a target on the horizontal plane and falls 12 m short when the angle of projection is 15^0, while it overshoots by 24 m when the angle is 45^0. Find the angle of projection to hit the target.   (17)

OR

X.   A vehicle weighing 10 kN is to turn a circular corner of radius 100 m on a level road with a speed of 10 m/s. The height of its CG above the road is 1 m and the distance between its wheels is 1.5 m. Find the reactions at the wheels. At what maximum speed can it travel the corner without the fear of overturning?   (17)

XI.   A wheel rotating about a fixed axis at 20 rpm is uniformly accelerated for 70 seconds during which it makes 50 revolutions. Find (i) the angular velocity at the end of this interval (ii) the time required for the velocity to reach 100 rpm.   (17)

OR

XII.   A homogenous circular disc of radius r and mass M is suspended from a point on its circumference. Determine its period of oscillation. Also calculate the time period if $r = 10$ cm.   (17)

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