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**B.Tech. Degree I Semester Regular/ Supplementary Examination in
Marine Engineering December 2021**

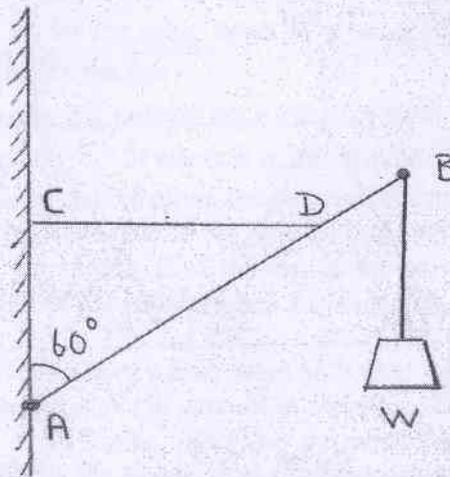
19-208-0104 ENGINEERING MECHANICS
(2019 Scheme)

Time: 3 Hours

Maximum Marks: 60

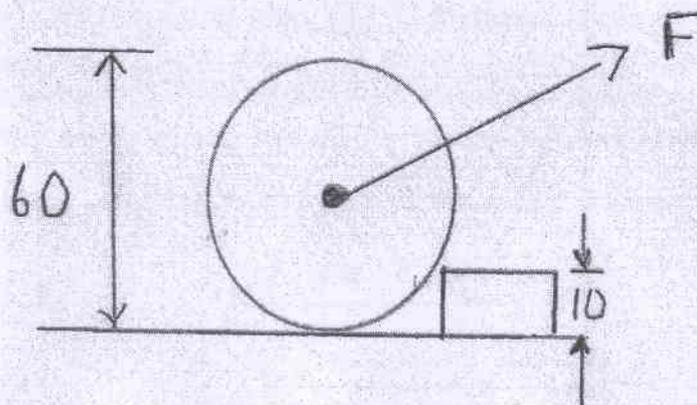
(5 × 15 = 75)

- I. (a) Find the magnitude of two forces such that if they act at right angles, their resultant is $\sqrt{10}$ KN and when they act at an angle of 60° , their resultant is $\sqrt{13}$ KN.
- (b) A bar AB 15 m long is hinged to a vertical wall at A, making an angle of 60° to the vertical and carries load 200 KN hanging vertically from the other end B. The bar is supported by a horizontal rope CD, C tied from the vertical wall at a distance of 10 m from the hinge. Find the tension in the rope and reaction of the hinge.



OR

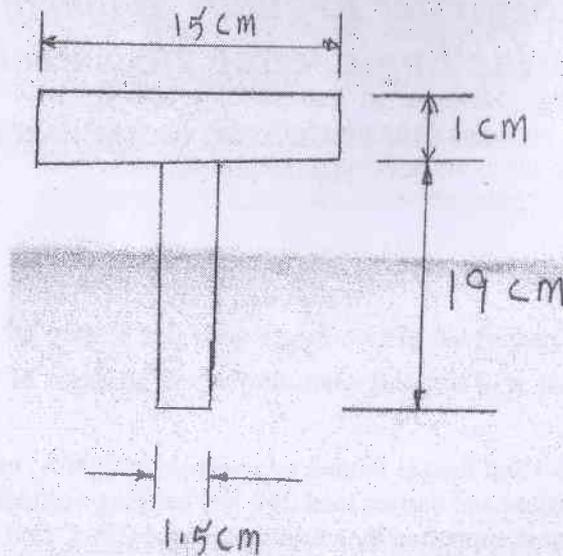
- II. (a) A vertical pole of 6 m height is fixed with the bottom and pulled by a string attached at top making an angle of 30° to the horizontal. Tension in the string is 15 KN. Find the horizontal force applied to the pole at 1.2 m above the ground so that the pole remain vertical.
- (b) A wheel of 60 cm diameter resting on the ground touches to a rectangular block of 10 cm height. Find the minimum pull required through the centre of the wheel just to turn the wheel over the corner of the block. Take weight of wheel as 1000 N. Assume all surface are smooth.



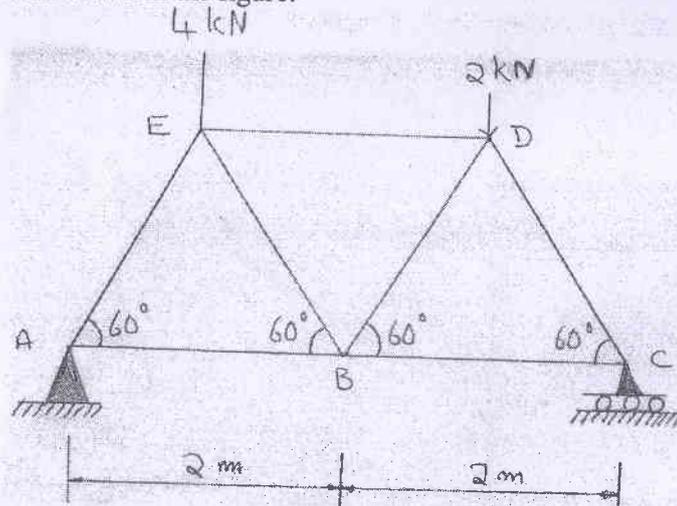
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- III. (a) Find out the MI and radius of gyration of a 'T' section about its centroidal axis parallel to the flange and perpendicular to the flange as shown in figure.

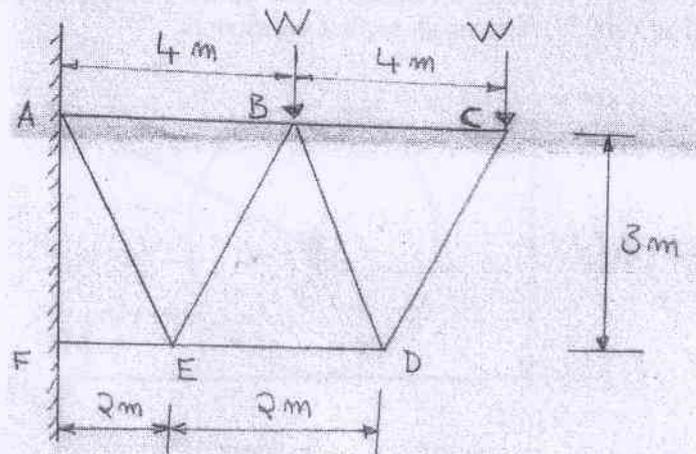


- (b) Determine the reactions and the forces in each member of a truss supported and loaded as shown in the figure.



OR

- IV. (a) Determine the moment of inertia of the mass of a homogenous right circular cylinder with respect to a diameter through the mass center of the cylinder in terms of radius 'R', height 'h' and mass 'm'.
 (b) Make calculations for the load 'W'. That would produce a force of magnitude 160 kN in the AB member of the cantilever truss as shown in figure. For this loading, workout forces in members AE and FE of the truss.



(Continued to 3)

BT-MRE-I(R/S)-12.21-1066

- V. (a) A toy car accelerates from rest at a constant rate of 2 m/s^2 for some time. Then it retards at a constant rate of 4 m/s^2 and comes to rest. If the car remains in motion for 3 seconds, determine the maximum speed attained and the total distance travelled by the car.
- (b) A glass marble whose weight is 0.2 N falls from a height of 12 m and rebounds to a height of 9 m. The marble and floor remain in contact for 0.1 second. Determine the impulse and average force between the marble and floor.

OR

- VI. (a) A motorist driving his car at 60 Km/hr. When he observes that a traffic light 250 m ahead turns red. The traffic light is timed to remain red for 20 seconds before it turns green. The motorist wishes to pass the traffic lights without stopping to wait for it to turn green. Make calculations for
- the required uniform deceleration of the car
 - the speed of the car as it passes the traffic light.
- (b) A wooden block of 750 N weight is placed on an inclined plane which makes an angle of 30° with the horizontal. What work will be done if the block is to be moved upwards the plane for 2.5 m distance and the coefficient of friction between the plane and the block is 0.2?
- VII. (a) Two adjacent guns shot the bullets at a velocity of 400 m/sec simultaneously at angles α_1 and α_2 for the same target at a range of 48 km. Calculate the time difference between the hits.
- (b) The position of a particle moving on a circular path with a radius of 10 m varies according to $S = t^2 + 2t$ where S is the distance in meters from a fixed point to the particle measured along the path and t is the time in seconds. The line from the centre of the path to the particle turns counter clock wise, when $t = 1$ second and the particle is at the top of the path when $t = 2$ seconds. Find the acceleration of the particle when $t = 2$ seconds.

OR

- VIII. (a) A motor cycle and rider have a total mass of 200kg. Find the angle which the motorcycle must make with the vertical in travelling around a curve of 10 m radius at a speed of 12 km/hr. Also find out what frictional force must the ground surface exert on the wheels if no skidding occurs at this speed.
- (b) A stone of mass 2 kg is whirling along a circle in vertical plane, Which is attached to a string of 50cm long. Determine the stone velocity and tension in the string when the stone is,
- at the highest point of the circle
 - at the lowest point of the circle
 - mid way position.
- IX. (a) The mass of a fly wheel mounted on a shaft of big capacity engine is 6 tonnes and radius of gyration is 1.5 m. The maximum and minimum speed of the fly wheel are 120 RPM and 115 RPM. Find the fluctuation of energy.
- (b) A solid disk type pulley of 800 kg with 200 cm diameter and 80 cm radius of gyration is rotated by an electric motor which exerts a uniform torque of $60 \times 10^3 \text{ Nm}$. A body of mass 3000 kg is to be lifted by a wire wrapped around the pulley. Find out
- acceleration of the body
 - tension in the rope.

OR

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- X. (a) A flywheel of 2000 kg mass of 1 meter radius of gyration is fitted to an engine. The starting torque on the engine is 1000 Nm. Determine the angular acceleration of the flywheel and its Kinetic Energy after 10 seconds from the start.
- (b) A body of mass 10 kg is suspended in a vertical plane as compound pendulum. The distance of centre of gravity of the body from the point of suspension is 10 cm. The frequency of oscillation of the body is 20/minute. Determine the moment of inertia of body about the point of its suspension
