

**January 2023**  
**B.Tech- III SEMESTER**  
**Engineering Mechanics (ELES305)**

Time: 3 Hours

Max. Marks:75

- Instructions:**
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
  2. Answer any four questions from Part -B in detail.
  3. Different sub-parts of a question are to be attempted adjacent to each other.
  4. Any missing Data may be suitably assumed.

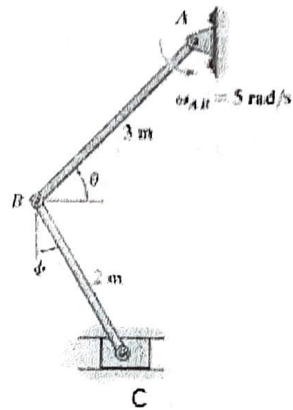
**PART -A**

- Q1 (a) What is Tensor? (1.5)
- (b) What is Eigen Value of a matrix? (1.5)
- (c) What is free body diagram? (1.5)
- (d) Scooter starts from rest and moves with a constant acceleration of  $1.2 \text{ m/s}^2$ . (1.5)  
 Determine its velocity, after it has travelled for 60 meters.
- (e) Find the moment of inertia of a rectangular section 30 mm wide and 40 mm (1.5)  
 deep about X-X axis and Y-Y axis.
- (f) A body of 5kg is rotating 60rpm in 6m radius, what will be angular (1.5)  
 momentum?
- (g) Define free Precession. (1.5)
- (h) A cantilever beam of 5m length is acted by 10 kN force at its end. Find Bending (1.5)  
 Moment at its center point.
- (i) What is modulus of Rigidity? (1.5)
- (j) What is Angle of Repose? (1.5)

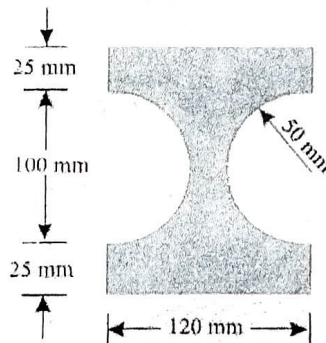
**PART -B**

- Q2 (a) The flywheel rotates with an angular velocity of  $v = (0.005\theta^2) \text{ rad/s}$ , where  $\theta$  is (10)  
 in radians. Determine the angular acceleration when it has rotated 20  
 revolutions.
- (b) Differentiate between Symmetric and anti-symmetric tensors. (5)
- Q3 (a) Describe The general plane motion of a rigid body by finding position, velocity (5)  
 and acceleration.
- (b) The angular velocity of link AB is  $V_{AB} = 5 \text{ rad/s}$ . Determine the velocity of block (10)

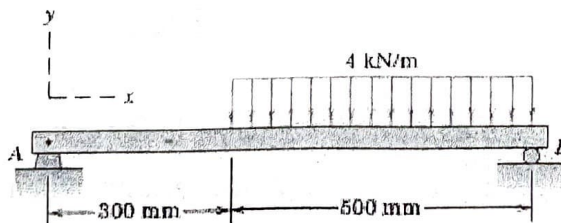
C and the angular velocity of link BC at the instant  $\theta = 45^\circ$  and  $\phi = 30^\circ$ . Also, sketch the position of link CB when  $\theta = 45^\circ, 60^\circ,$  and  $75^\circ$  to show its general plane motion.



Q4 Figure shows the cross-section of a cast iron beam. Determine the moments of inertia of the section about horizontal and vertical axes passing through the centroid of the section. (15)

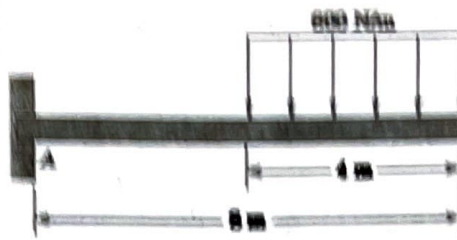


Q5 (a) Determine the reactions at A and B for the beam subjected to the uniform load distribution. (5)



(b) Determine the shear and moment diagrams for the loaded cantilever beam. (10)  
Specify the shear V and Moment M at the middle section of the beam.





- Q6 (a) Derive an expression for strength of a solid Circular shaft. (5)
- (b) A solid shaft of 180 mm diameter has the same cross-sectional area as a hollow shaft of the same material with inside diameter of 120 mm. Find the ratio of (a) powers transmitted by both the shafts at the same angular velocity. (b) angles of twist in equal lengths of these shafts, when stressed to the same intensity (10)
- Q7 (a) Differentiate between Static friction and coulomb friction. (5)
- (b) Discuss about the kinematic and kinetic constraints that they impose on a rigid body. (10)

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(10)

(10)

(10)

(10)

(10)