



B.Tech II Semester Supplementary Examinations, September 2023
Engineering Mechanics
(Common to CE & ME)

Maximum Marks: 70

Date: 22.09.2023 Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
 3. Part B consists of 5 Units. Answer any one full question from each unit.
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks.

(10x2M = 20 Marks)

1. Divide the 100 N force acting 30° to horizontal into two components.
2. State the D' Alembert principle.
3. State the Numerical formula of Polar Moment of Inertia.
4. Explain the types of supports and indicate the reactions they offer.
5. Define the system of forces. Sketch the Concurrent system of forces.
6. A body weighing 20 N is projected up a 20° inclined plane with a velocity of 12 m/s, coefficient of friction is 0.15. Find the maximum distance S that the body will move up the inclined plane.
7. State the Pappu's theorem-II and determine the volume of a cylinder using it.
8. State the Pappu's theorem -I.
9. What are the parameters that define rectilinear motion? State the relationship between these parameters.
10. The potential energy of a body is 39600J. How high is the body if its mass is 20kg?

Part-B

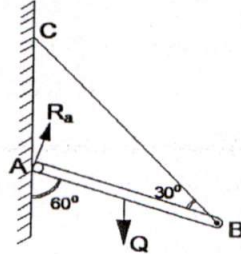
Answer All the following questions.

(5X10M = 50 Marks)

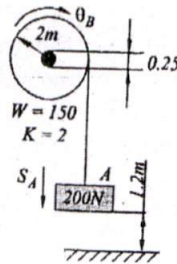
- 11.(a) What do you understand by the term 'Couple'? Discuss the characteristics of a couple. 5
- (b) Three forces of magnitude 150N, 300N and 500N are acting at the origin O (0, 0, 0) and are directed from the points A (3, 2, 4), B (3, -2, -4) and C (-1, -3, -4) respectively to the origin. Determine the magnitude of the resultant. 5

OR

12. A prismatic bar AB of weight $Q = 17.8 \text{ kN}$ is hinged to a vertical wall at A and supported at B by a cable BC, as shown in the following figure. Determine the magnitude and direction of the reaction R_a at the hinge A and the tensile force F in the cable BC. 10

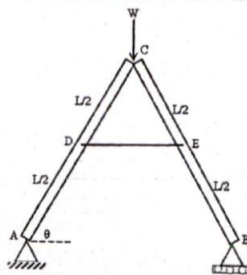


13. A pulley of radius 2 m, weighing 150 N is mounted over an axle of diameter 0.25 m. The friction between pulley and axle is constant at 50 N. It supports a block A of weight 200 N and start from rest from the position shown in the following figure. Calculate the turns the pulley makes before it stops, if block A dropped from a height of 1.2 m. 10



OR

14. A 20 Kg block starting from rest slides up a 30° inclined plane under the action of a 175 N force directed along the inclined plane. The coefficient of kinetic friction between the block and the plane is 0.2. Determine the (i) speed of the block after it slides 4.5 m and (ii) the distance travelled by the block when its speed becomes 4.5 m/s. 10
15. State and prove the equation for polar moment of inertia. 10
- OR
- 16.(a) An isosceles triangle section ABC has a base of 100 mm and 60 mm height. Determine the moment of inertia of triangle about the centroid and about base. 5
- (b) Define centroid and centre of gravity 5
- 17.(a) Derive an expression for tension in the cable in terms of θ and W . Use method of virtual work. 5



- (b) Mention the forces which are generally omitted while applying the principle of virtual work. 5

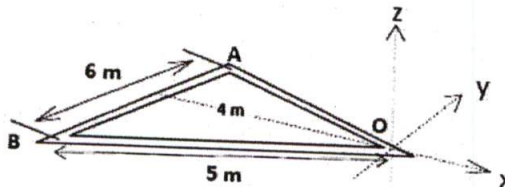
OR

18.(a) Differentiate between area moment of inertia and mass moment of inertia.

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(b) A uniform steel rod is bent into the shape of an isosceles triangle ($OA = OB$). Calculate the mass moment of inertia about an axis through O perpendicular to the plane of the figure. The total mass of the rod is 12 Kg.

5



19.(a) A body of mass 10 Kg is suspended by a string of length 1 m. It is struck by a bullet travelling horizontally with a velocity of 450 m/sec. The bullet weights 30 gms and gets embedded into the body after striking it. Determine the maximum angle through which the body swings.

5

(b) A body moving with simple harmonic motion has amplitude of 1 m and a period of oscillation of 2 seconds. What will be its velocity and acceleration 0.4 seconds after passing an extreme position?

5

OR

20. Derive the time period for simple pendulum

10

