



B.E/B.TECH DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Second Semester

COMMON TO AERO / AUTO / CIVIL / MCE

U18MET2003: Engineering Mechanics

COURSE OUTCOMES

- CO1:** Apply the fundamental concepts in determining the effect of forces on a particle.
CO2: Make use of various principles in the determination of effect of forces in a rigid body.
CO3: Determine the geometry dependent properties of solids and sections.
CO4: Solve problems in static friction.
CO5: Identify motion and determine the velocity and acceleration of a particle.
CO6: Apply the principles of kinetics in solving problems in dynamics.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. Define resolution of a force. | CO1 | [K ₁] |
| 2. List the difference between moment and couple. | CO2 | [K ₂] |
| 3. Infer free body diagram. | CO1 | [K ₂] |
| 4. Compare and contrast the difference between centroid and center of gravity. | CO3 | [K ₂] |
| 5. Outline pappus and guldinus theorems. | CO3 | [K ₂] |
| 6. State D' Alembert's principle | CO5 | [K ₁] |
| 7. Define coefficient of restitution. | CO4 | [K ₁] |
| 8. Highlight the difference between kinematics and kinetics. | CO6 | [K ₂] |
| 9. A bus beginning to move with an acceleration of 0.3m/s^2 . A man who is 12m behind the bus starts running at 3m/s to catch the bus. After how many seconds will the men able to catch the bus. | CO5 | [K ₂] |
| 10. What do you mean by projectile and why it need to be studied? | CO6 | [K ₂] |

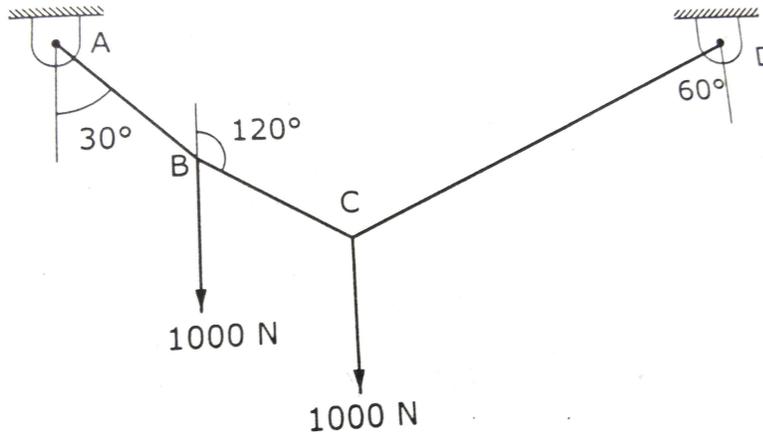
Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

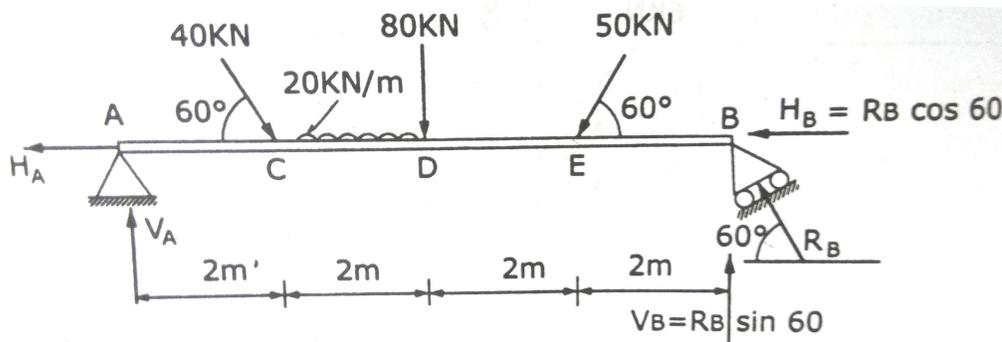
(Answer not more than 400 words)

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|---|---|-----|-------------------|
| 11. a) Find the magnitude of the two forces, such that if they act at right angles, their resultant is $\sqrt{10}\text{N}$. But if they act at 60° , their resultant is $\sqrt{13}\text{N}$. | 6 | CO1 | [K ₂] |
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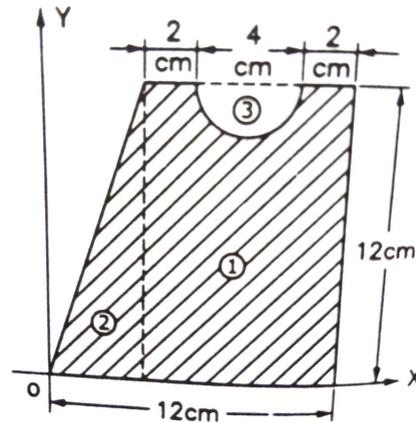
- b) A string ABCD, attached to two fixed points A and D has two equal weights of 1000 N attached to it at B and C. The weights rest with the portions AB and CD inclined at angles of 30° and 60° respectively, to the vertical as shown in fig. Find the tensions in the portions AB, BC and CD of the string, if the inclination of the portion BC with the vertical is 120°



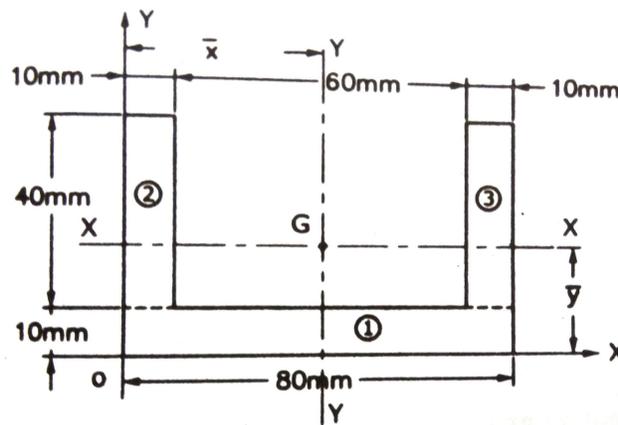
12. a) ABCD is a square and E is the middle point of AB. Forces of 7, 8, 12, 5, 9 and 6N act at a point in the directions AB, EC, BC, BD, CA and DE respectively. Find the magnitude and direction of the single force which will keep the body at rest.
- b) Find the reactions at the supports A and B of the beam shown in fig



13. a) Find the moment of inertia of plane area shown below in fig. about its centroidal axes. 8 CO3 [K₂]
axes.

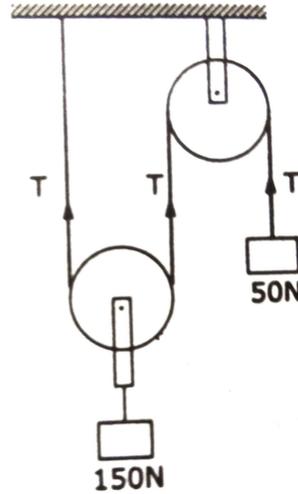


- b) Find the moment of inertia of the section shown below in fig. 8 CO3 [K₂]



14. a) A uniform ladder of weight 1000N and of length 4m rests on a horizontal ground and leans against a smooth vertical wall. The ladder makes an angle of 60° with horizontal. When a man of weight 750N stands on the ladder at a distance 3m from the top of the ladder, the ladder is at the point of sliding. Determine the coefficient of friction between the ladder and the floor. 6 CO4 [K₂]
- b) A block overlying a 10° wedge on a horizontal floor and leaning against a vertical wall and weighing 1500 N is to be raised by applying a horizontal force to the wedge. Assuming co-efficient of friction between all the surfaces in contact to be 0.3. Determine the minimum horizontal force to be applied to raise the block. 10 CO4 [K₂]

15. a) An airplane is flying on a straight level course at 200 km/hr at a height of 1000 meter above the ground. An anticraft gun located on the ground fires a shell with an initial velocity of 300 m/s, at the instant when the plane is vertically above it. At what inclination, to the horizontal, should the gun be fired to hit the plane? What time after firing, the gun shell will hit the plane? What will then be the horizontal distance of the plane from the gun? 8 CO6 [K₂]
- b) Two blocks of weight 150 N and 50 N are connected by a string and passing over a frictionless pulley as shown in fig. Determine the acceleration of blocks A and B and the tension in the string. 8 CO6 [K₂]



16. a) A spring of stiffness 0.5 N/mm is placed, horizontally and a ball of mass 5 kg strikes the spring horizontally with a velocity equal to that attained by a vertical fall of height 120mm. Find the maximum compression of the spring using law of conservation of Mechanical energy. 8 CO5 [K₂]
- b) A ball is dropped from a height of 10m on a fixed steel platform. Determine the height to which the ball rebounds on the first, second and third bounces. The co-efficient of restitution between the ball and the plate is 0.9. 8 CO5 [K₂]
