B.E. Mechanical Engineering (Model Curriculum) Sem-III

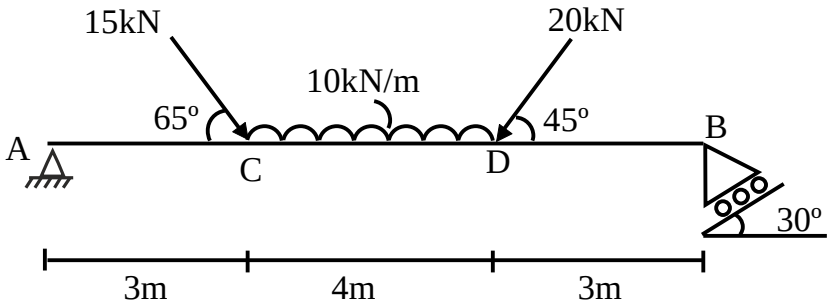
ESC202 : Engineering Mechanics

P. Pages : 4 **GUG/W/22/14057**

Time : Three Hours * 3 2 8 6 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) For the beam shown in figure determine reaction at support. **8**

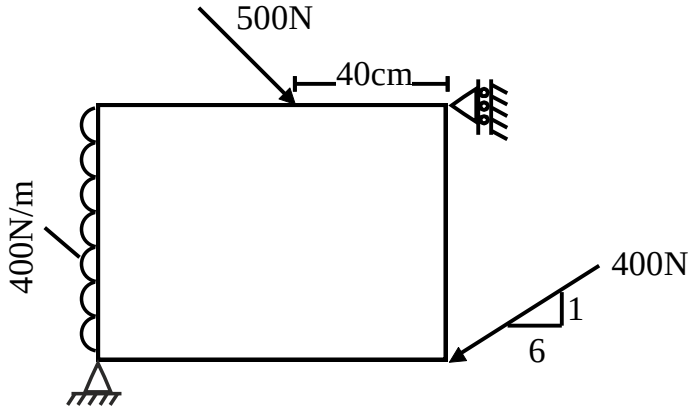


b) State the Varignons theorem. **4**

c) Explain the principle of transmissibility of forces. **4**

OR

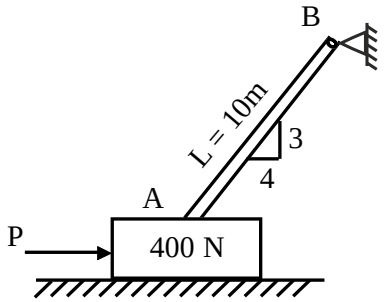
2. a) A square block ABCD of 80cm dimension having its self weight 200N is loaded and supported shown in fig. Determine support reaction **8**



b) What do you understand by the term 'free body diagram'? Illustrate your answer with a few sketches. **4**

c) State and explain resolution and composition of forces in cartesian coordinate system. **4**

3. a) A uniform bar 10m long & weighing 280N is hinged at B & rest upon a 400 N block at A as shown in figure. If the co-efficient of friction is 0.4 at all contact surfaces, find the horizontal force P required to start moving the 400N block **10**



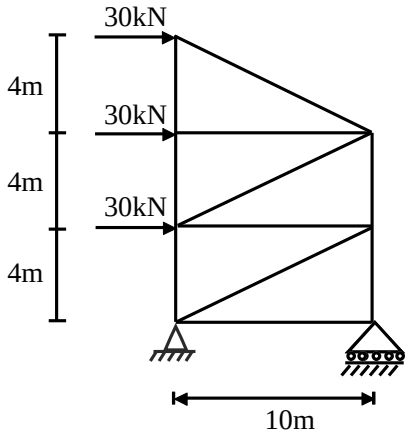
b) Define limiting friction and state the laws of friction. **6**

OR

4. a) Derive the formula of coil friction. **5**

$$\frac{T_2}{T_1} = e^{\mu B}$$

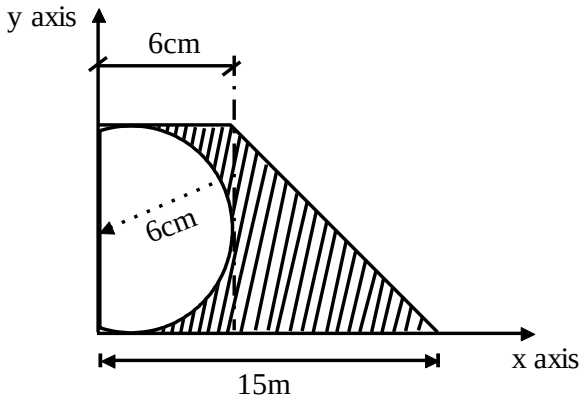
b) Determine the forces in all the members of truss shown in fig. **11**



5. a) For the shaded area as shown. **10**

i) Locate position of centroid

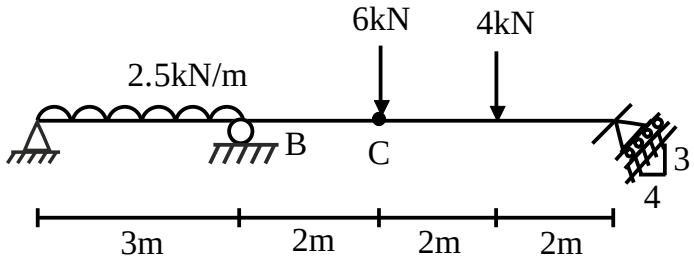
ii) Find moment of inertia about the specified x, y axis



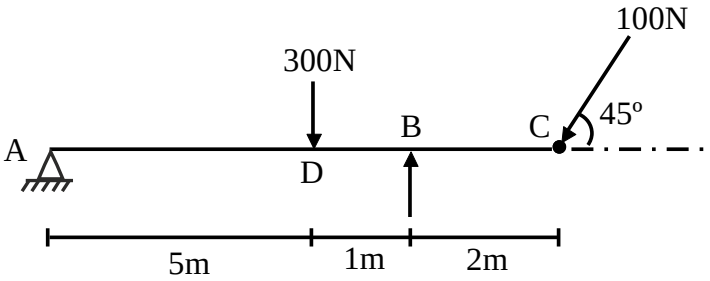
b) Explain the perpendicular axis theorem and parallel axis theorem. **6**

OR

6. a) Determine the reaction at A, B & E by using principle of virtual work. There is an internal hinge at C. **8**



b) Using virtual work principle, calculate the support reaction at A & B for the beam as shown in figure. **8**



7. a) The rectangular components of the acceleration for a particle $a_x = 3t$ and $a_y = 30 - 10t$, where a in meter per sec^2. If particle starts from rest at origin. Find the radius of curvature of path at t = 2 sec. **8**

b) A projectile when fired from a gun at 30º with horizontal falls short of the target placed at same elevation by 600m. When it is fired at 35º it overshoots the target by 900m. **8**
Find:

i) Distance of the target

ii) Initial velocity of projectile

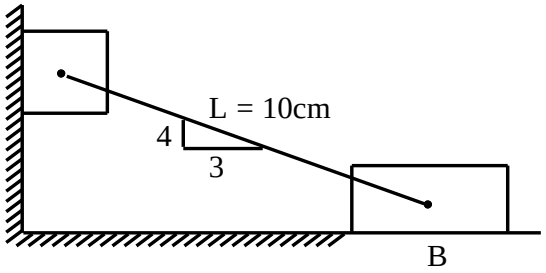
iii) Exact inclination of projectile to score the hit.

OR

8. a) The motion of a particle is rectilinear motion is define by $a = \sqrt[6]{v}$, where a in m/sec^2 and v in m/sec when t = 2 sec, v = 36 m/sec and s = 30m, determine the value of s and at t = 3 sec. **8**

b) Define rectilinear motion, curvilinear motion, rotation and relative motion. **8**

9. a) In the given figure determine acceleration of blocks A and B at the given position when the system is released from rest. A weights 300N and B weights 400N. Assume surfaces are smooth. **12**



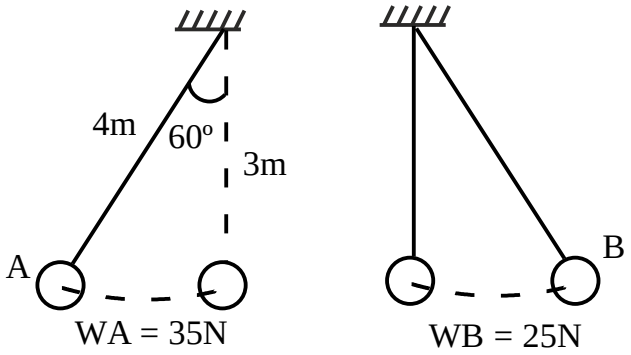
b) Explain coefficient of restitution. **4**

OR

10. a) Explain D'Alembert's principle. **4**

b) The ball A & B are attached to stiff rods of negligible weights. Ball A is released from rest as shown in figure and allowed to strike B. If e = 0.6 determine maximum angle θ through which ball B will swing. What is the maximum and minimum tension in the rod attached to B? **12**

If impact lasts for 0.01 sec. also find the average impact force.



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