

Course Code: ESC106A

Course Title: Construction Materials and Engineering Mechanics

Lecture No. 24:

Problems on Equilibrium of Coplanar Concurrent Force systems - Connected Bodies

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Lecture Intended Learning Outcomes

At the end of this lecture, students will be able to:

- Apply the Lami's theorem to solve equilibrium related problems (for 3 force system)
- Apply the conditions of equilibrium to solve problems (for more than 3 force system)
- Calculate the unknown forces or reactions for equilibrium of coplanar concurrent force system involving connected bodies



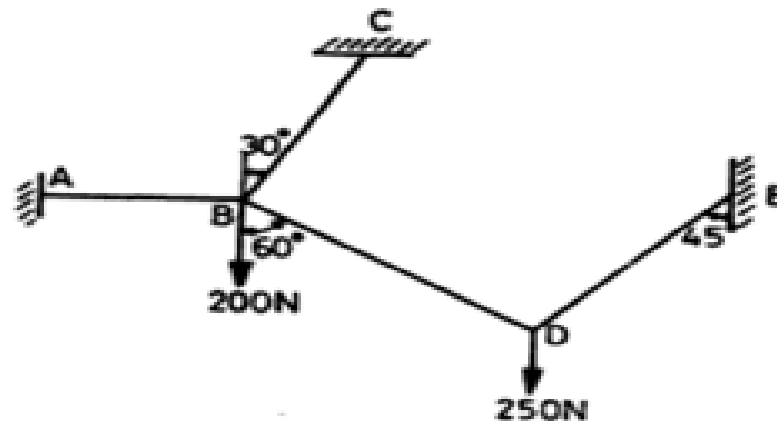
Contents

Lami's theorem to solve equilibrium related problems (for 3 force system), Solve problems applying conditions of equilibrium



Problems

1. A system of connected flexible cables shown in fig is supporting two vertical forces 200N and 250N at points B and D. Determine the forces in various segments of the cable



$$T_1 = 224.14\text{N}$$

$$T_2 = 183.01\text{N}$$

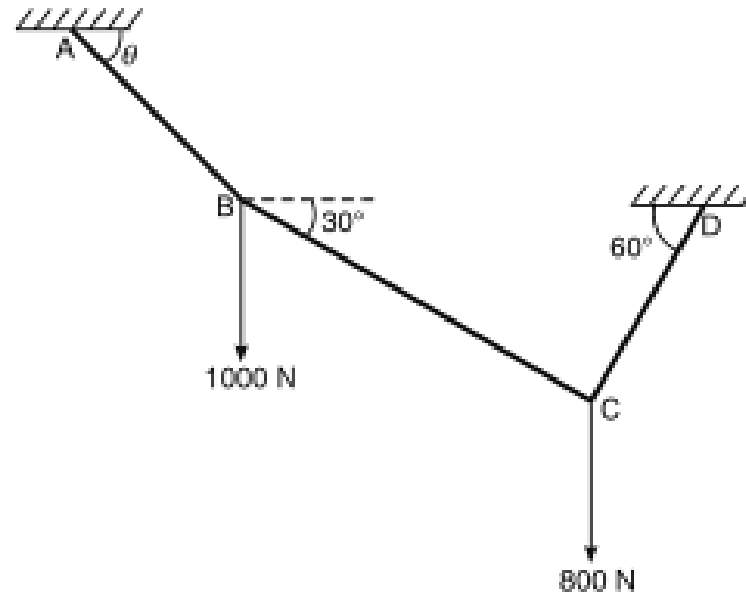
$$T_3 = 336.60\text{N}$$

$$T_4 = 326.79\text{N}$$



Problems

2. Compute the tensions in the string AB, BC, CD as shown in the figure



$$T_{AB} = 1249.158 \text{ N}$$

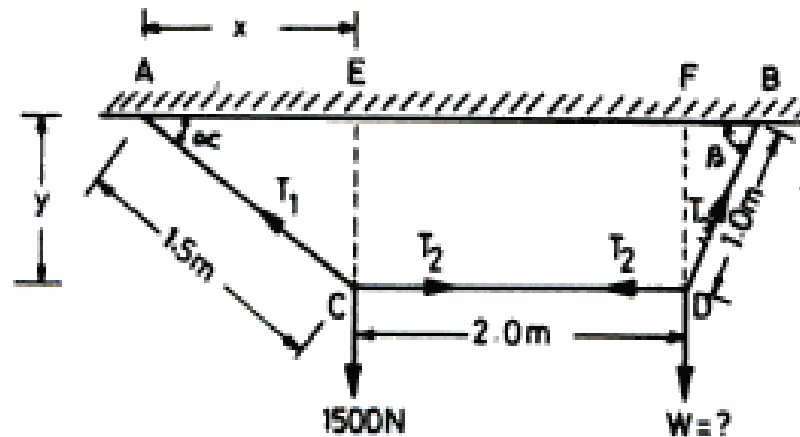
$$T_{BC} = 400 \text{ N}$$

$$T_{CD} = 692.82 \text{ N}$$



Problems

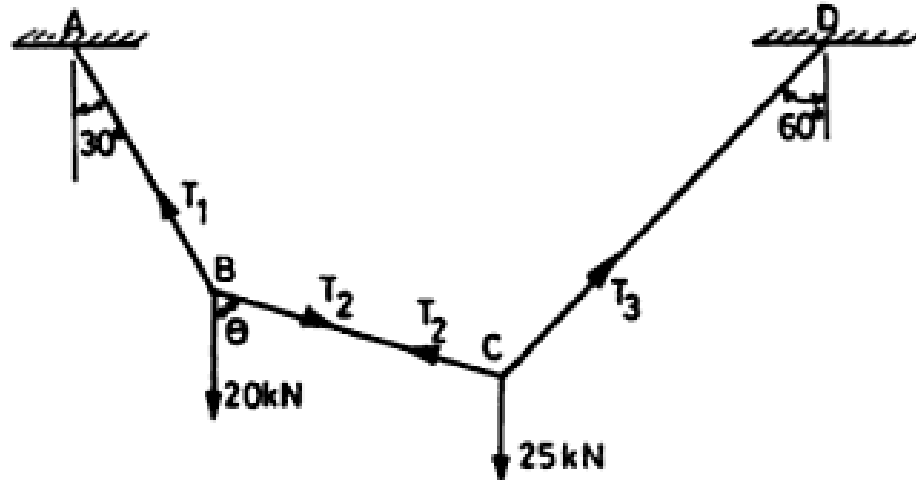
3. A rope AB, 4.5m long is connected at two points A and B at the same level 4m apart. A load of 1500N is suspended from a point C on the rope 1.5m from A as shown in the fig. What load connected at point D on the rope, 1m from B will be necessary to keep the position CD level?



$$\begin{aligned} T_1 &= 3098.39\text{N} \\ T_2 &= 2711.09\text{N} \\ T_3 &= 3993.28\text{N} \\ W &= 2863.53\text{N} \end{aligned}$$

Problems

4. A wire is fixed at two points A and D as shown in the figure. Two weights 20kN and 25kN are supported at B and C respectively. When equilibrium is reached it is found that inclination of AB is 30° and that of CD is 60° to the vertical. Determine the tension in the segments AB, BC and CD of the rope and also the inclination of BC to the vertical.



$$\begin{aligned} T_1 &= 38.97 \text{ kN} \\ T_2 &= 23.84 \text{ kN} \\ T_3 &= 22.5 \text{ kN} \end{aligned}$$



Summary

- Lami's Theorem states that if a body is in equilibrium under the action of three forces, each force is proportional to the sine of angle between the other forces
- Lami's theorem is applied to solve problems on equilibrium of Coplanar Concurrent Force systems

