

Course Code: ESC106A

Course Title: Construction Materials and Engineering Mechanics

Lecture No. 25:

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)
- Evaluate the unknown forces or reactions for equilibrium of coplanar concurrent force system involving connected bodies



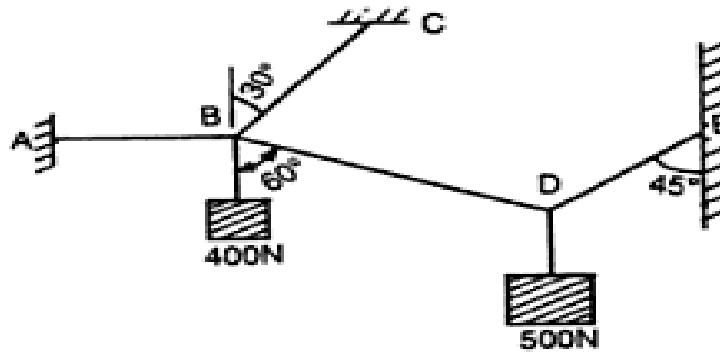
Contents

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 loads 400N and 500N at points B and D. Determine tensions in various segments of the cable.



$$T_{AB} = 653.58 \text{ N}$$

$$T_{BC} = 673.2 \text{ N}$$

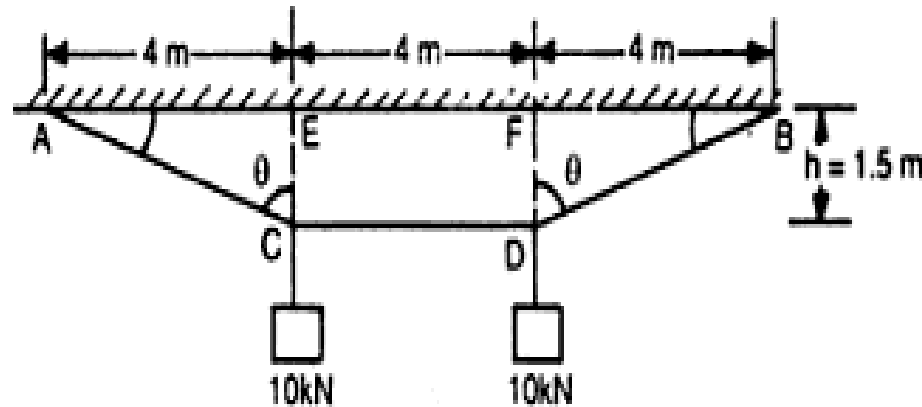
$$T_{BD} = 366.02 \text{ N}$$

$$T_{DE} = 448.29 \text{ N}$$



Problems

2. Two equal loads are supported by a flexible cable ACDB as shown in figure. Determine tensile force developed in portion AC, CD and DB respectively, if the span $L=12\text{m}$ and sag $h=1.5\text{m}$. Neglect weight of the cable.



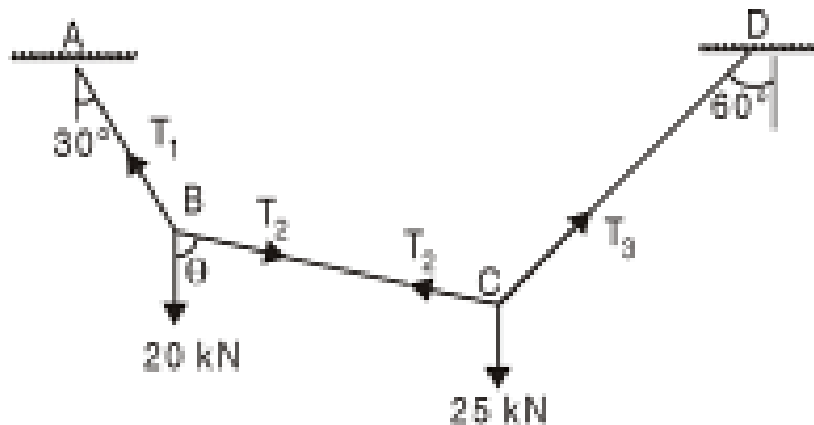
$$T_{AC}=28.48\text{N}$$

$$T_{CD}=26.27\text{N}$$

$$T_{DB}=28.48\text{N}$$

Problems

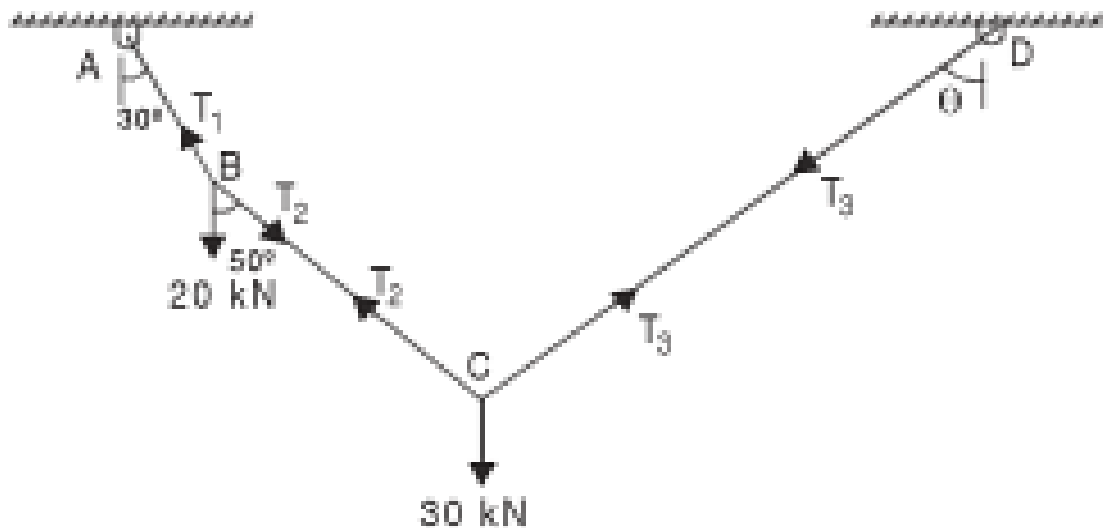
3.A wire is fixed at two points A and D as shown in fig. Two weights 20kN and 25kN are supported at B and C respectively. When equilibrium is reached it is found that inclination of AB is 30° and that of CD is 60° to the vertical. Determine the tension in the segments AB, BC and CD of the wire and also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



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

Problems

4.A wire is fixed at two points A and D as shown in fig. Two weights 20kN and 30kN are attached to it at B and C respectively. The weights rest with portions AB and BC inclined at angles 30° and 50° respectively, to the vertical as shown in figure. Find the tension in the wire in segments AB ,BC and CD and also the inclination of the segments CD to vertical



$$\begin{aligned}T_1 &= 44.79 \text{ kN} \\T_2 &= 29.24 \text{ kN} \\T_3 &= 25.045 \text{ kN}\end{aligned}$$



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

