Course Code: ESC106A
Course Title: Construction Materials and Engineering Mechanics

Lecture No. 22:
Problems on Equilibrium of Coplanar Concurrent Force Systems- Single Bodies

Delivered By: Mr. Shrihari K. Naik

Lecture Intended Learning Outcomes

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

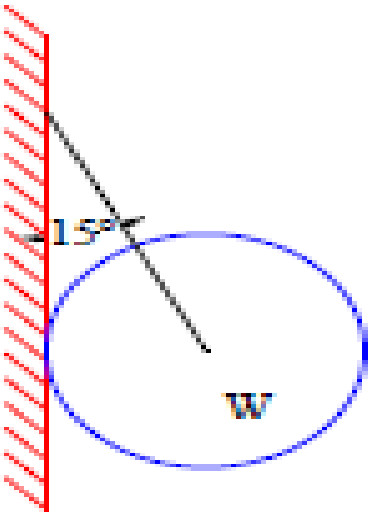
- Apply the Lami's theorem to solve equilibrium related problems (for 3 force system)
- Apply the conditions of equilibrium to solve problems (for more than 3 force system)
- Calculate the unknown forces or reactions for equilibrium of coplanar concurrent force system involving single bodies

Contents

Lami’s theorem to solve equilibrium related problems, equilibrium of coplanar concurrent force system involving single bodies

Problems

1.A sphere of weight 100 N is tied to a smooth wall by a string as shown in Fig .Find the tension T in the string and reaction of the wall.

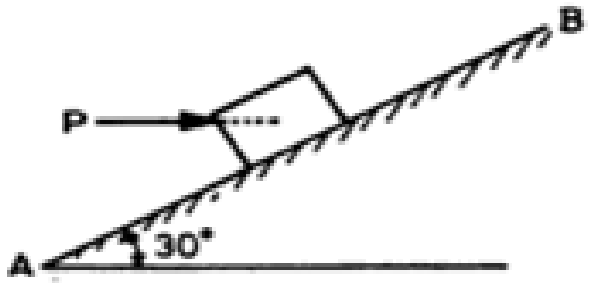


T=103.53N

R=26.79N

Problems

2.Determine the horizontal force P to be applied to a block of weight 1500N to hold it in position on a smooth inclined plane AB which makes an angle of 30˚ with the horizontal

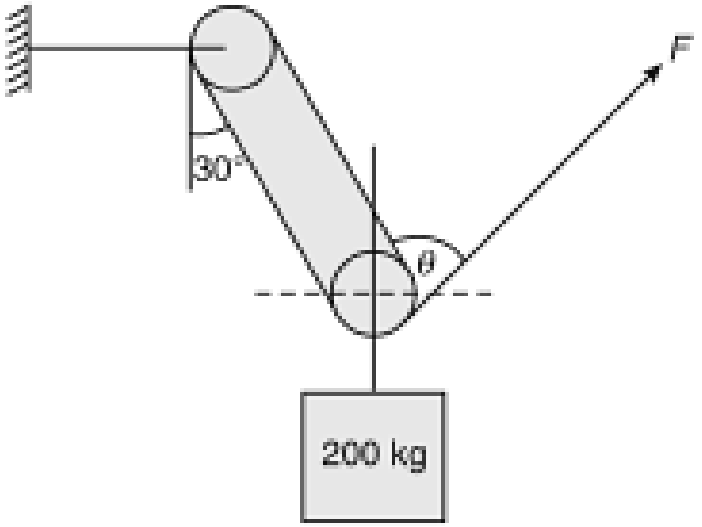


R=1732.06N

P=866.03N

Problems

3.A crate of mass 200kg is to be supported by a rope and pulley arrangement as shown in the figure. Determine the minimum required magnitude of force F.Also find the direction of force F.

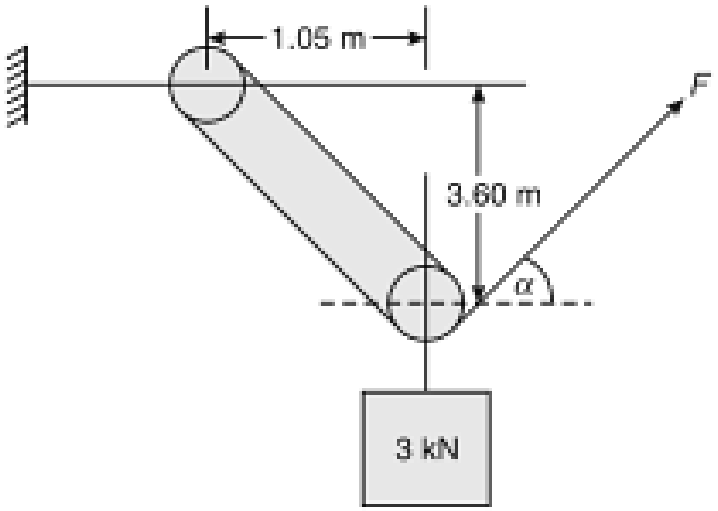


F=981N

θ=60˚

Problems

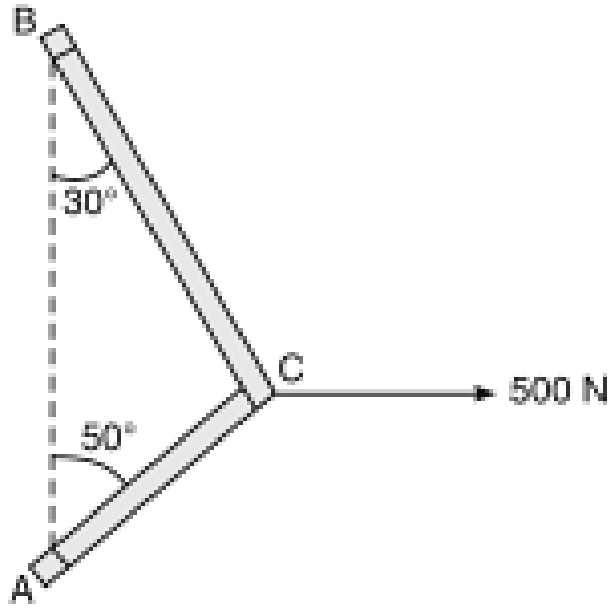
4.A 3kN crate is supported by the rope and pulley arrangement shown in figure. Determine the magnitude and the direction of the minimum force F that should be exerted at the free end of the rope.



F=0.839kN

Problems

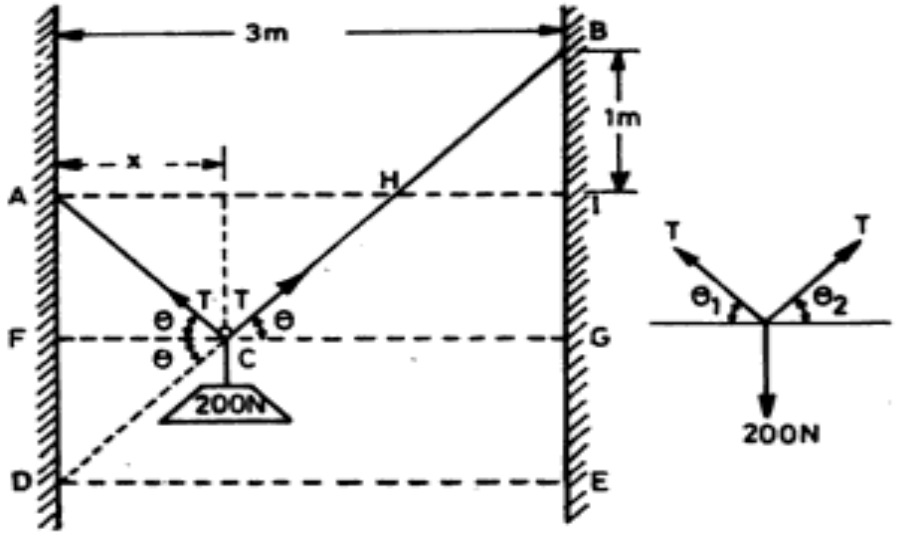
5.Determine the forces induced in the members AC and BC of the structure shown in figure.



T_{CB}=326.35kN
T_{CA}=439.69kN

Problems

6.A cord ABC 5m long is attached at points A and B to two vertical walls 3m apart as shown in fig. A pulley C of negligible radius carries a suspended load of 200N and is free to roll without friction along the cord. Determine the position of equilibrium, as defined by the distance X, that the pulley will assume and also the tensile force in the cord



X=1.125m

T=125N

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