

**GOVERNMENT COLLEGE OF ENGINEERING, JALGAON**

(An Autonomous Institute of Government of Maharashtra)

National Highway No.6, JALGAON – 425 002

Phone No.: 0257-2281522

Website : www.gcoej.ac.in

Fax No.: 0257-2281319

E-mail : princoej@rediffmail.com

Name of Examination : **Summer 2021** - (Preview)Course Code & Course Name : **CE151U - Engineering Mechanics**Generated At : **19-04-2022 12:54:36**Maximum Marks : **60**Duration : **3 Hrs**

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**Answer Key Submission Type:** No marking scheme and solution

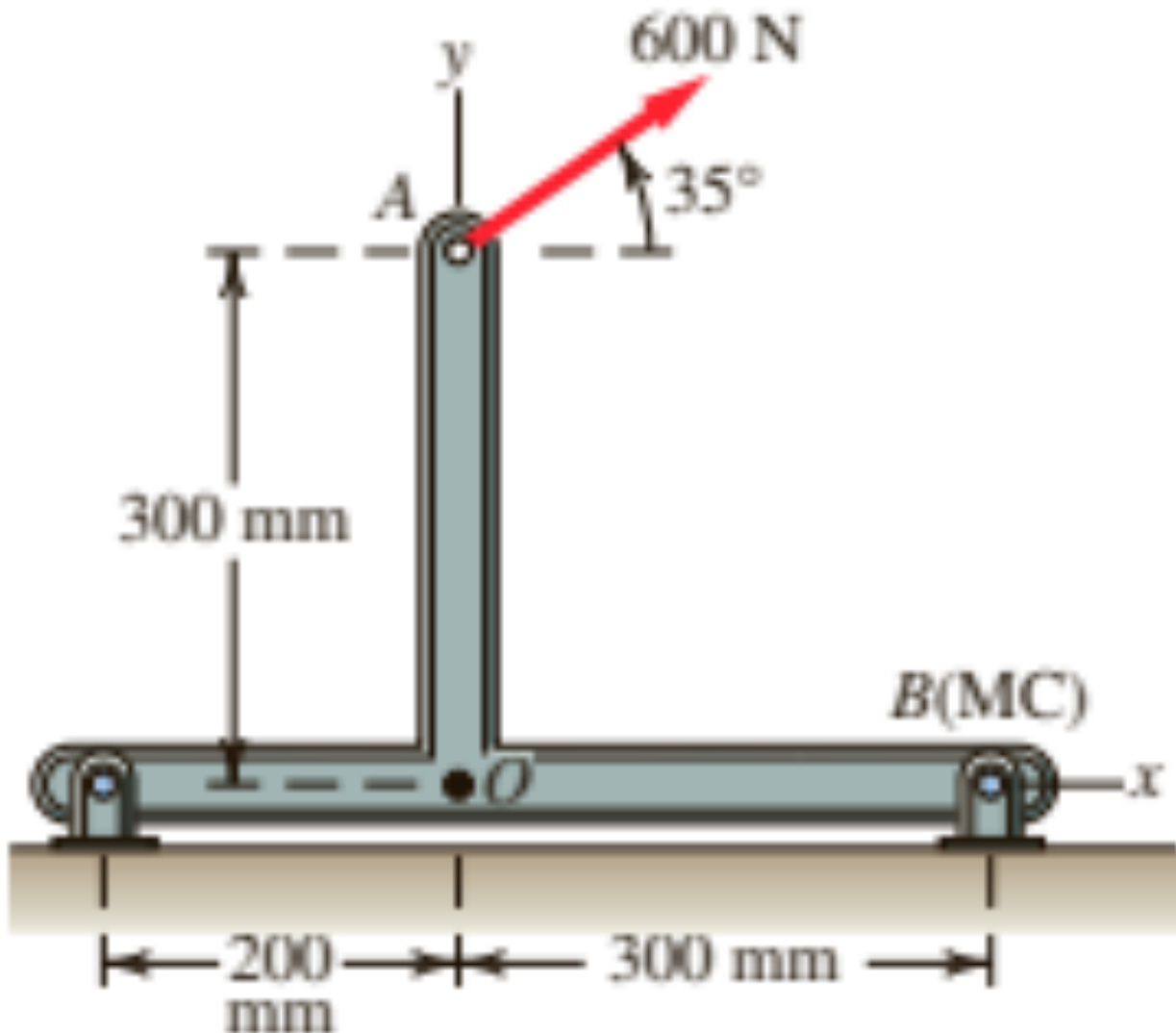
Instructions:

1. All questions are compulsory.
2. Illustrate your answer with suitable figures/sketches wherever necessary.
3. Assume suitable additional data; if required.
4. Use of logarithmic table, drawing instruments and non programmable calculators is allowed.
5. Figures to the right indicate full marks.

1) Solve **any SIX** of the following :

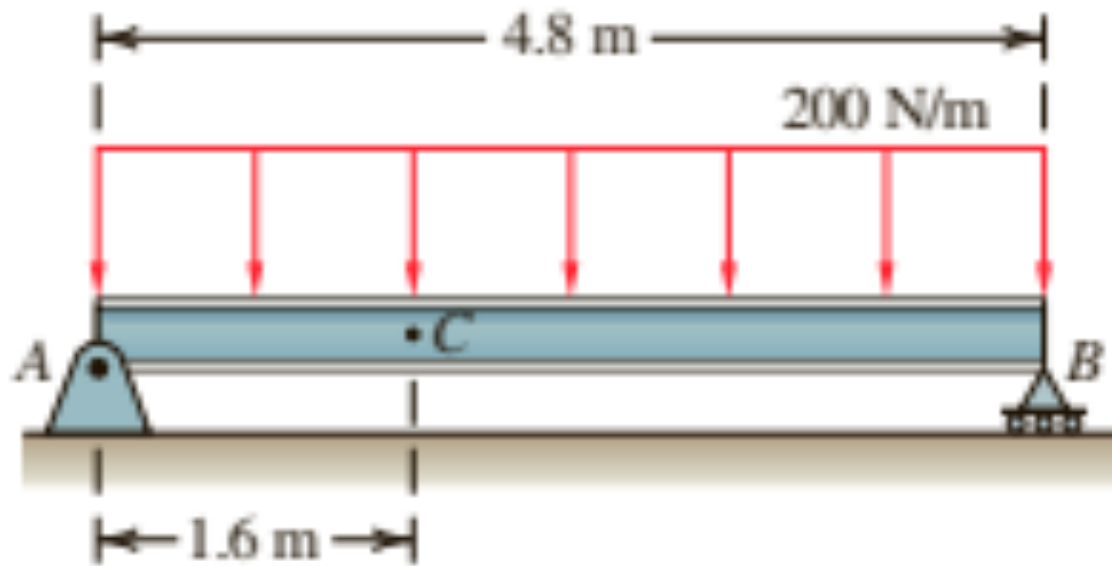
- a) Calculate the moment of 600N force that creates at the moment center (MC) located at B.

[4]

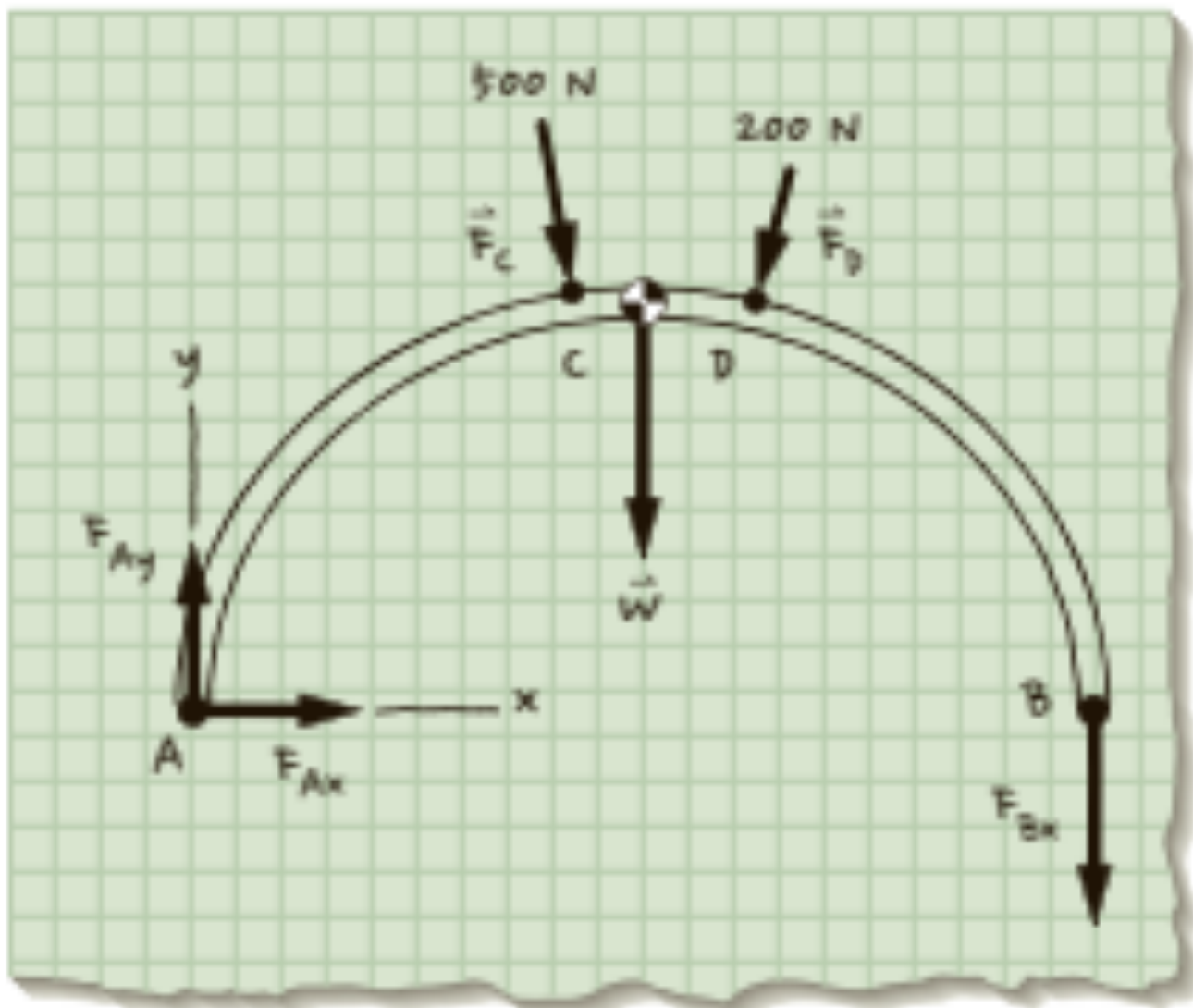
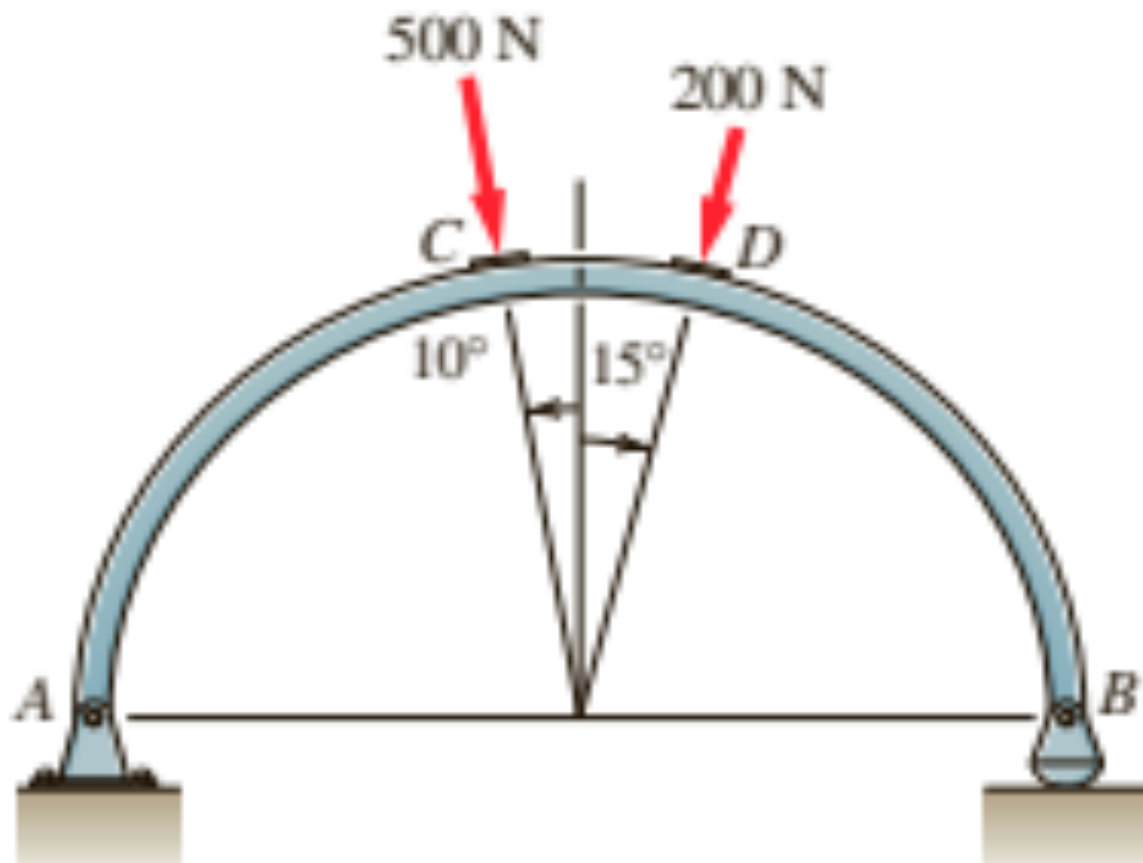


- b) Determine reaction at support  $A$  and  $B$  using Principle of Virtual work. Verify your solution using the Equations of Equilibrium.

[4]

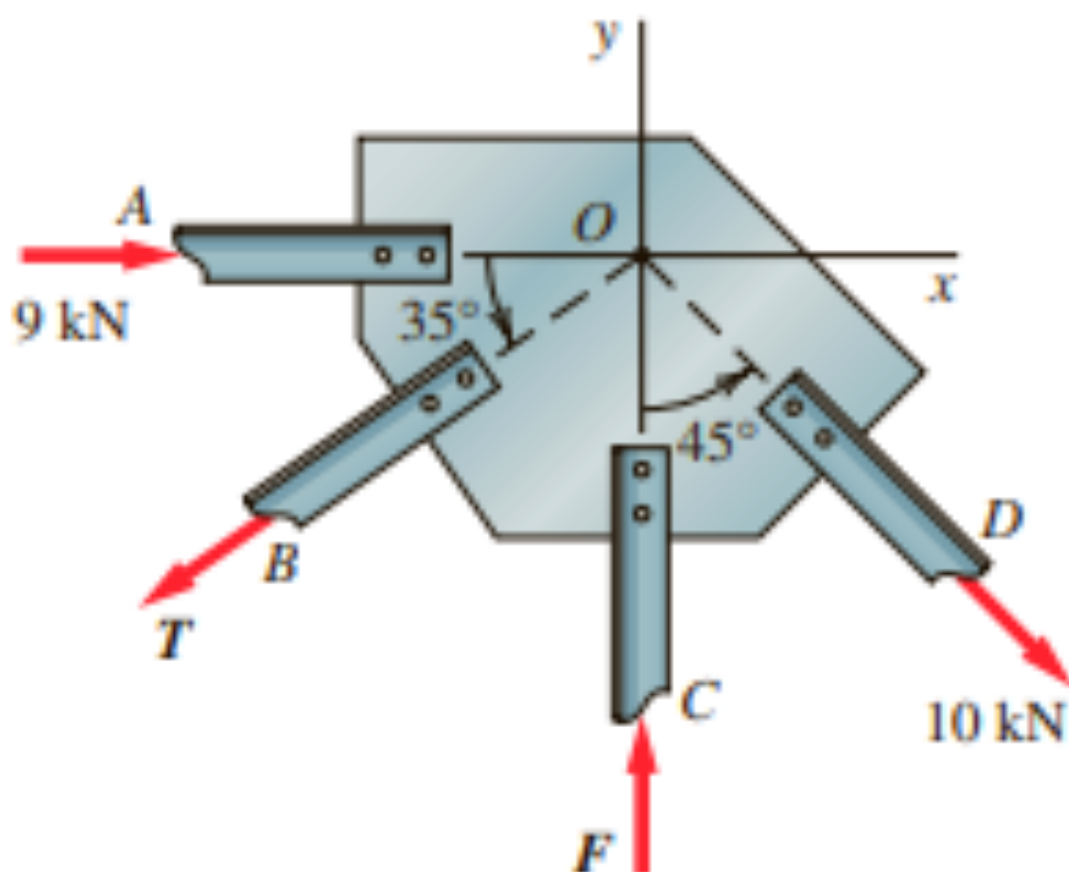


- c) A semicircular uniform beam of weight  $W$  is supported at A by a pin connection and at B by a rocker, as shown. Is the proposed free-body diagram correct? If not, indicate what is wrong. [4]



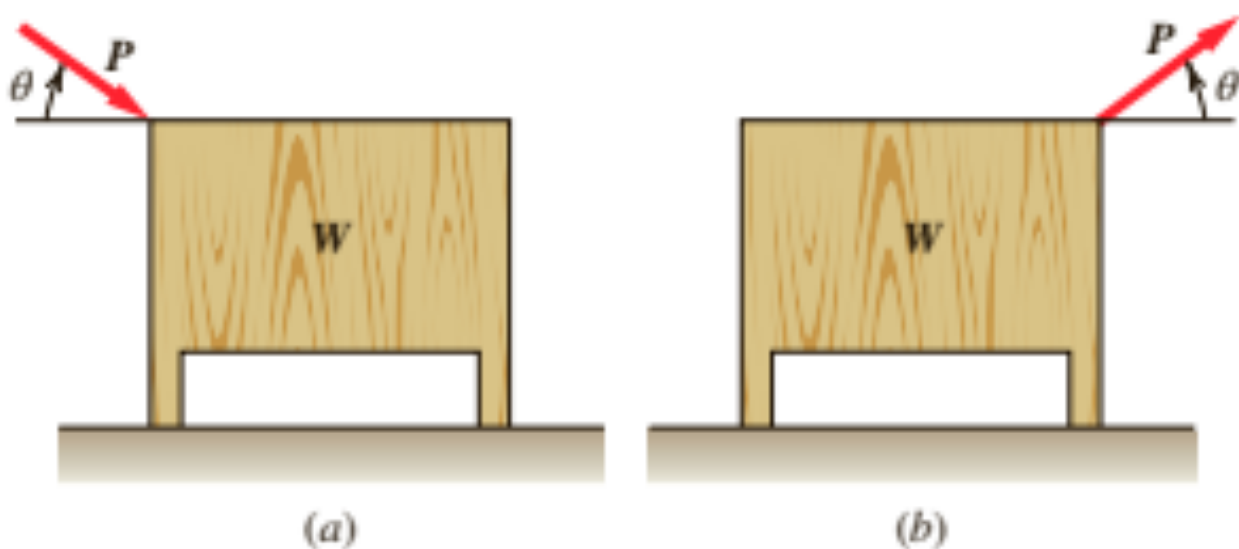
- d) Member of a truss are connected to the gusset plate, as shown. If the forces are concurrent at point  $O$ , determine the magnitudes of  $F$  and  $T$  for equilibrium.

[4]

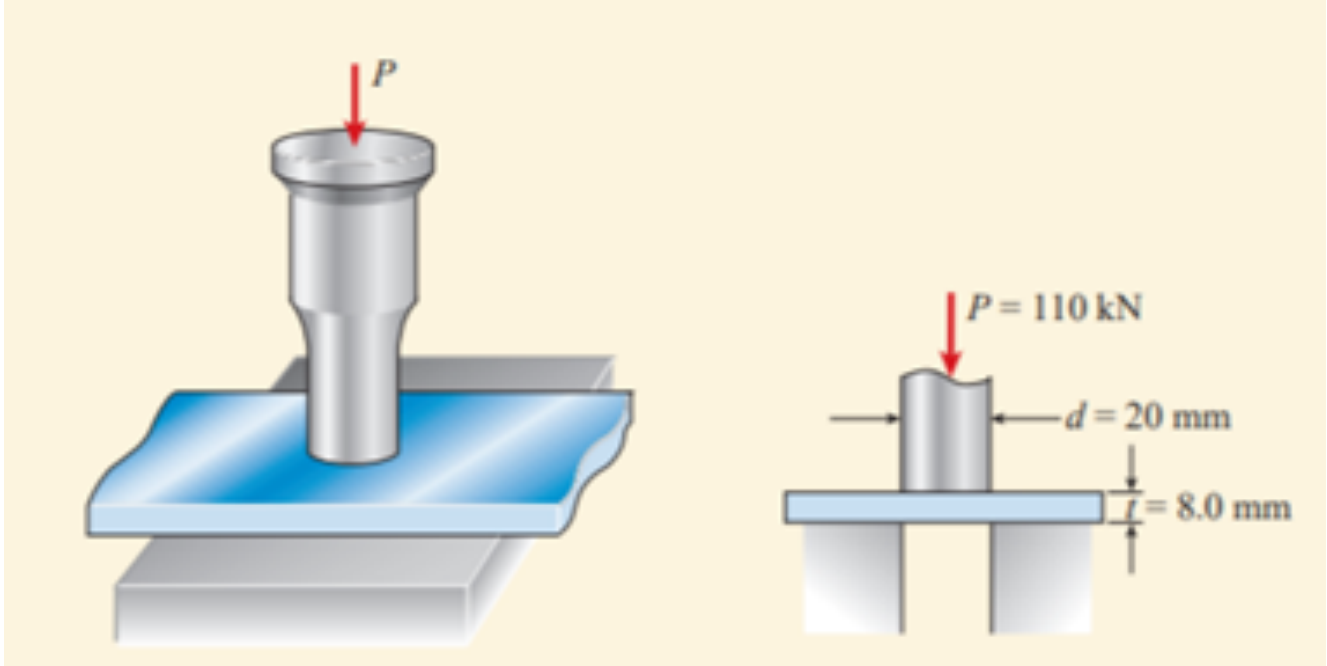


- e) Two students are moving desks around a class-room. Student (a) thinks pushing the desk will require less force. Student (b) thinks it will require less force to pull on it. Who is right? Explain your reasoning.

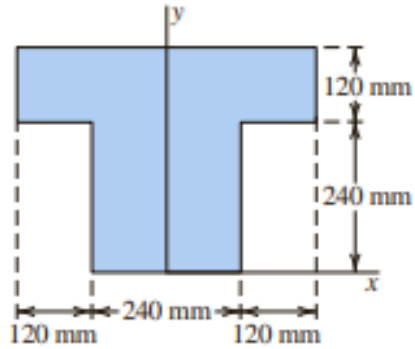
[4]



- f) A punch for making holes in steel plates is shown in Figure below. Assume that a punch having a diameter of 20 mm is used to punch a hole in 8 mm thick plate, as shown in the cross-sectional view. If a force  $P = 110 \text{ kN}$  is required, what is the average shear stress in the plate and the average compressive stress in punch? [4]

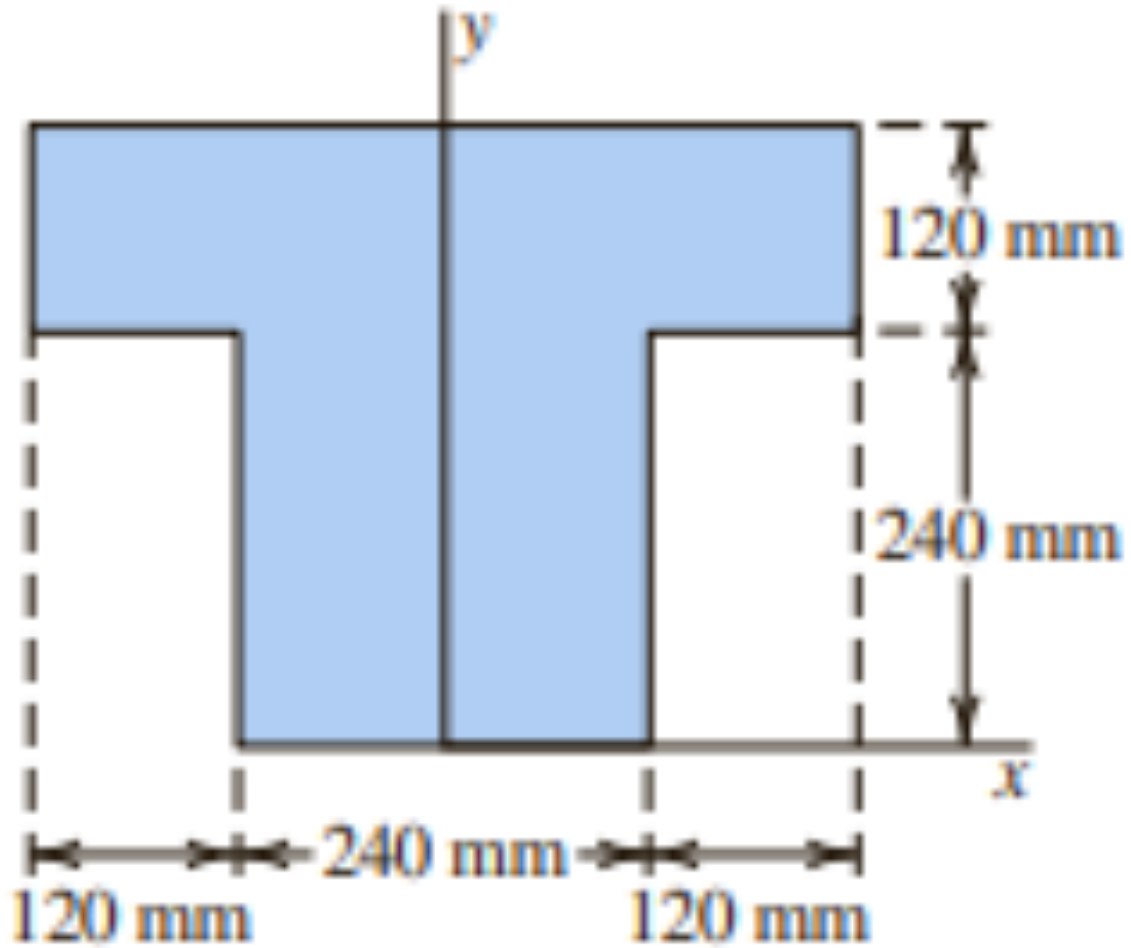


- g) Determine the location of the centroid for the T-shaped area. [4]



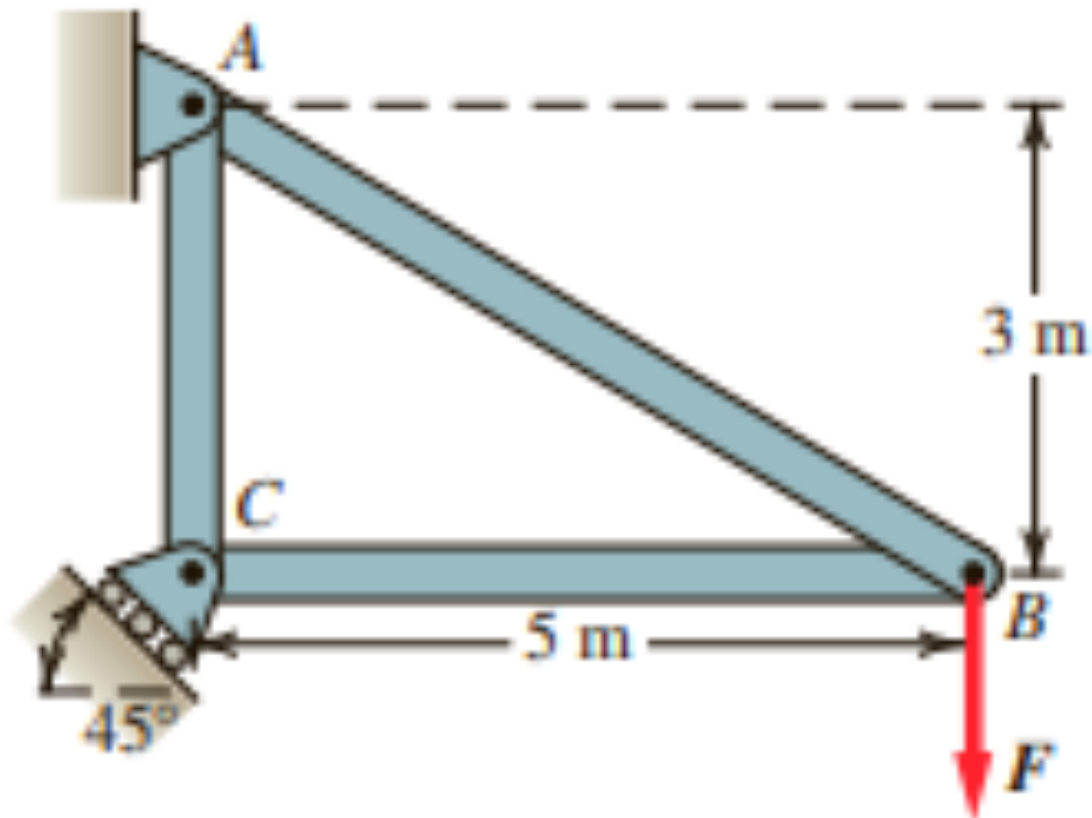
- h) Determine the moments of inertia about x-axis and y-axis for the T-shaped area shown below.

[4]



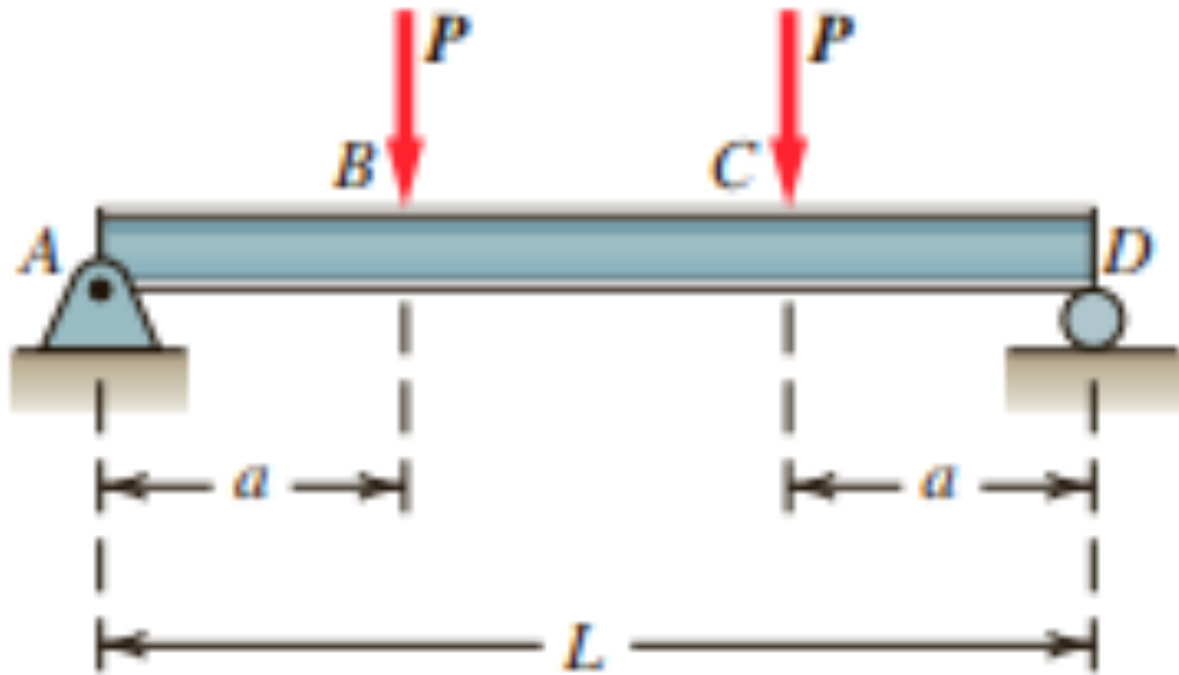
- 2) a) Consider the pin-jointed truss loaded as shown below. Determine the force in each member. State whether each member is in tension or compression.

[6]



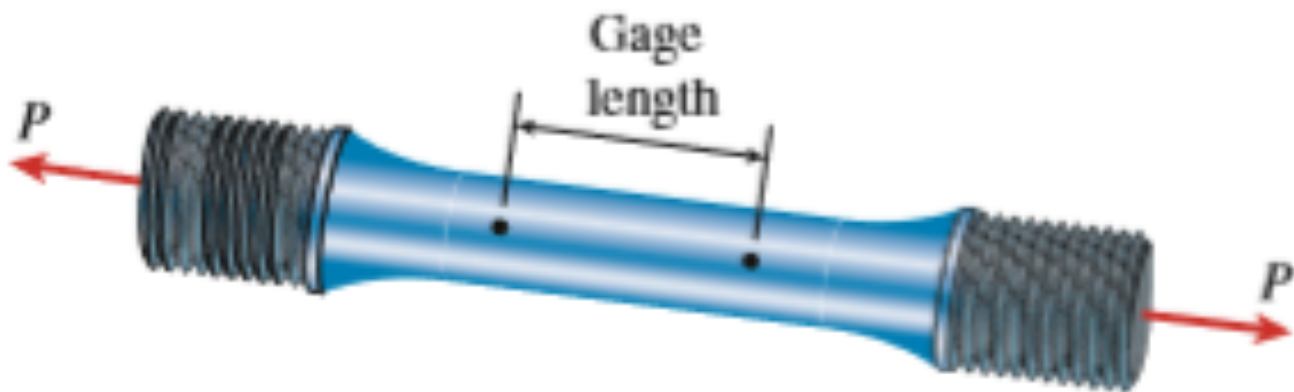
- b)  $ABCD$  is a horizontal beam carrying vertical loads as shown in Figure. Draw the shear force and bending moment diagrams.

[6]



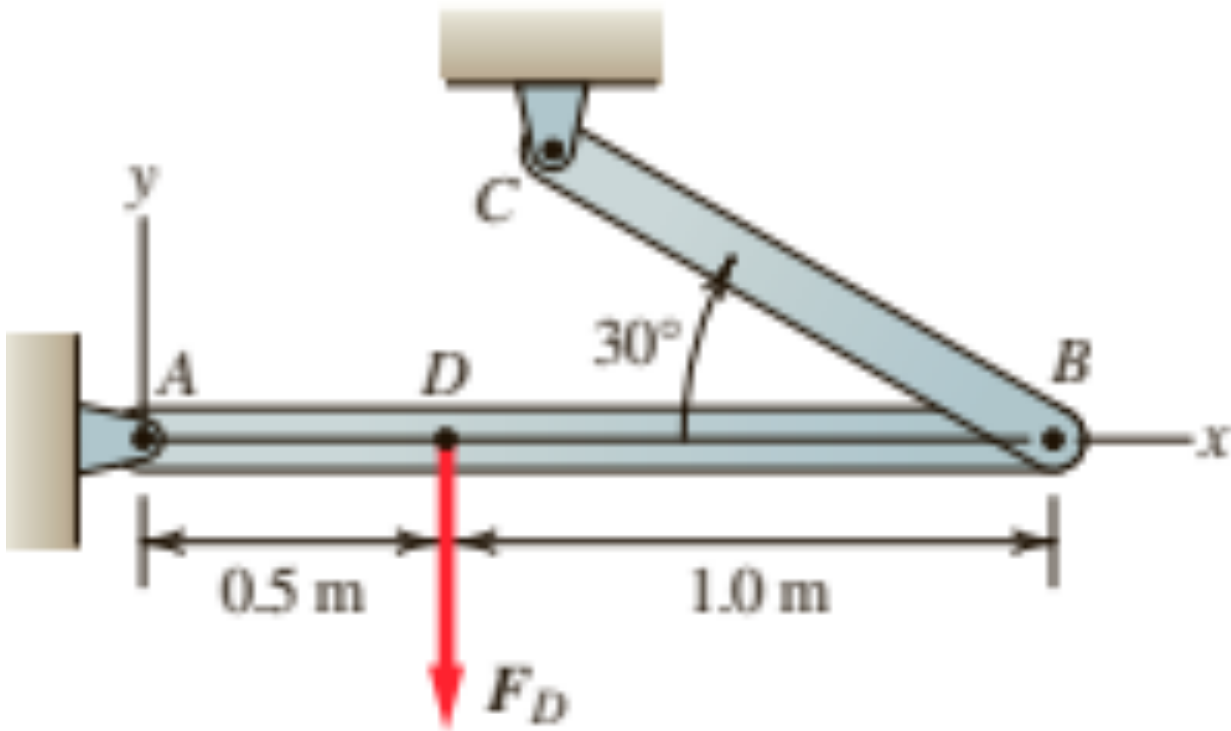
- 3) Solve **any TWO** of the following :

- a) A test specimen is tested in tension having diameter of 12 mm and gauge length of 50 mm. At failure the distance between the gauge marks is found to be 63.0 mm. also, the diameter at the failure cross section is found as 9.46 mm. Determine the percent elongation and percent reduction in the area of specimen. [6]

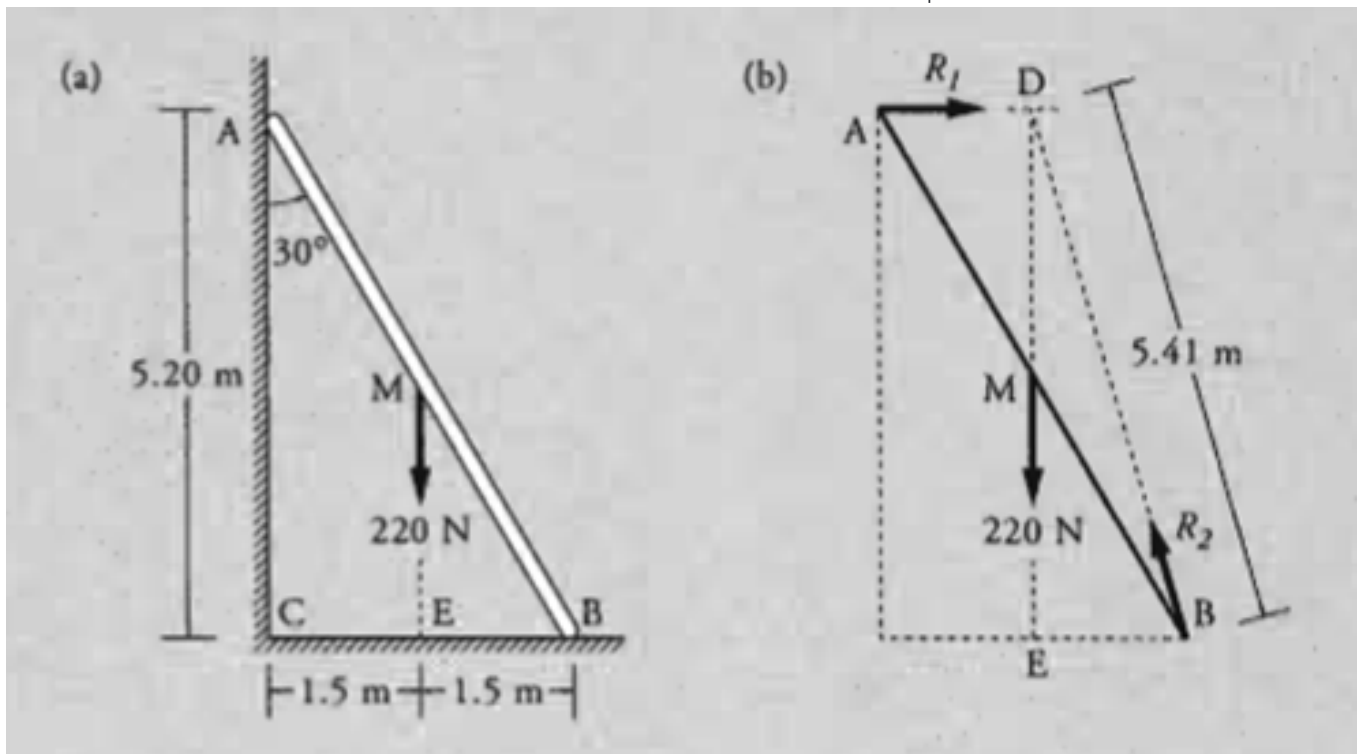




- b) Beam  $AB$  is loaded with 750-N load at  $D$  and supported as shown in the Figure. Weights of various members are negligible. Find the reactions for beam  $AB$  at  $A$  and  $B$ . [6]



- c) A ladder 6 m long and weighing 220 N rests against a smooth (i.e. frictionless) wall at an angle of  $30^\circ$  to the vertical. Find the reactions at the wall at  $A$  and the floor at  $B$ . Also show that the minimum coefficient of friction between ladder and the floor is 0.29 so that the ladder will not slip. [6]



- 4) Solve **any THREE** of the following :

- The time-velocity graph of a particle is a straight line joining the point  $t=0, v=10$  mm/s and the point  $t=10$  s,  $v=-10$  mm/s. [4]
  - What is the acceleration of the particle?
  - Determine the position  $x$  of the particle at 8 s ( $x=0$  for  $t=0$ )
- A man moves a crate by pushing horizontally against it until it slides on the floor. The coefficient of static friction is 0.50, and the coefficient of sliding friction is 0.40. With what acceleration [ $\text{m/s}^2$ ] does the crate begin to move? Assume that the force exerted by the man at impending motion is maintained when sliding begins. [4]
- An archer pulls a bowstring back 450 mm with a 130 N force. The arrow weighs 2.25 N. Assuming that the force applied is linearly proportional to the deflection and that 20 % of the strain-energy of the bow is lost to internal friction, determine the speed with which the arrow leaves the bow. [4]
- A machine gun fires 480 bullets per minute. Each bullet weighs 0.275 N, and leaves the muzzle of the gun horizontally with a speed of 1000 m/s. Determine the average force exerted by the gun on its support. (Apply the principle of impulse-momentum for 1 s interval) [4]