Housekeeping

- Disc Worksheet reading!
- Quiz 4 starts!
- Thursday
  - ME HW 15
- Saturday
  - Quiz 4 ends
- Sunday
  - WA 8
...on pins, on members

Forces on members = pin reactions

Forces on pin = "member reactions"
Determine the horizontal and vertical components of force at pins A and D.
\[ \Sigma M_A: \]

\[ (F_{DB}, \sin \theta)(d_1) + (T)(r) - (T)(2d_1) - T(2d_1 + r) = 0 \]

\[ \Sigma M_A: (F_{DB}, \sin \theta)(d_1) + T(1 - 2d_1 - 2d_1 - r)^2 \]

\[ \Sigma M_A: (F_{BD}, \sin \theta)(d) = \frac{4T d_1}{2T(2d_1)} \]
The pumping unit is used to recover oil. Determine the torque $\mathbf{M}$ which must be exerted by the motor in order to overcome this load.
Chapter 7: Internal Forces
Beams are structural members designed to support loads applied perpendicularly to their axes.

Beams can be used to support the span of bridges. They are often thicker at the supports than at the center of the span.

Why are the beams tapered? Internal forces are important in making such a design decision.
• Reaction forces in each leg approximately the same in both loading scenarios

• However, each location of the table top experiences different values for the internal forces

Lect 22: Internal Forces
Simplest case: method of sections

FBD beam

FBD of sections

LHS
Internal loadings developed in structural members

- Determine the internal loading at point B of the cantilever beam

**Forces**
- Tension (pulls apart)
- Compression (squeezes together)
- Shear

**Moments**
- Bending
Internal loadings developed in structural members

Structural Design: need to know the loading acting within the member in order to be sure the material can resist this loading

**Cutting** members at internal points reveal **internal forces and moments**.

2D ⇒ Normal, shear, bending

3D ⇒ torsion, twisting

https://www.youtube.com/watch?v=hLfNCAHPL8c BCT540 Truss Test, Group 2

https://www.youtube.com/watch?v=YdqvGGFlbfc Steel Rebar Tensile Test
Sign conventions:

Positive normal force

Positive shear force

Positive moment

Lect 22: Internal Forces
Procedure for analysis:

1. Find support reactions (free-body diagram of entire structure)
2. Pass an imaginary section through the member
3. Draw a free-body diagram of the segment that has the least number of loads on it
4. Apply the equations of equilibrium

Find the internal forces and moments at B (just to the left of P) and at C (just to the right of P)
Determine the normal force, shear force, and bending moment at $C$ of the beam.
Determine the normal force, shear force, and bending moment acting at point $E$ of the frame.
Lect 22: Internal Forces

Diagram showing a structural member with dimensions and forces applied.

- Dimensions: 1 m, 0.5 m
- Forces: 600 N