# UNIFIED HANDOUT

# MATERIALS AND STRUCTURES - #M-11

Spring, 2009

# Concept Review Sheet

*for Unified Q1M:* Units M4.1-4.2

## OVERALL ASPECTS re/ SOLVING STRUCTURAL PROBLEMS

- The 15 equations of elasticity are always applicable.
- Modeling assumptions of three types are made for the structural member: on geometry, on the loading/stress state, on the displacement/strain state.
- All surfaces have boundary conditions either on stresses or displacements.
- There are basically two approaches to solving structural problems as modeled: exact/analytical and numerical techniques.
- St. Venant's Principle tells us that "far away" from boundaries, the general solution holds.

## THE ROD/BAR

- A rod is long compared to its other two dimensions  (L >> b,h).
- The load applied is along the axial direction (long dimension).
- There are no variations in the directions perpendicular to the long dimension.
- The cross-section deforms uniformly.
- The pertinent internal resultant is the axial load, F.
- The axial resultant load at any location along the rod is equipollent to the axial stress acting and integrated over the "cut" surface.
- The pertinent structural stiffness is the modulus of the material along the long dimension times the cross-sectional area, EA.
- There is a slight inconsistency in the model when applying the equations of elasticity with regard to the displacements and strains in the directions perpendicular to the long direction.