Ph.D. Qualifying Examination

Mechanics of Materials

Fall 2019

Notes:

- There are a total of 4 problems.
- Time allowed: 2.5 hours.
- Exam is closed book and closed-notes (one sheet of formulas is allowed)
- Problems count 25 points each (total=100 points).
- Show your work on these exam sheets. (Add additional sheets, if needed.)
- You may use a calculator.
- Laptops and cell phones are not allowed.

1. Determine the maximum bending stress for the shape below. The applied bending moment around the *x*-axis is 17 kN-m as shown.

175mm

15mm

$\bar{y}$

17kN·m

250mm

12mm

Cross-section
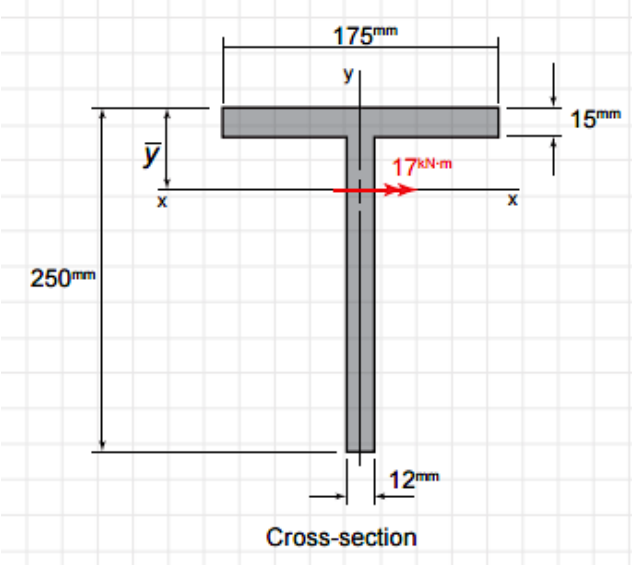
2. The state of plane stress at a point on a body is represented on the element shown in the figure. Represent this stress state in terms of maximum in-plane shear stress and associated average normal stress.

100 MPa

60 MPa

20 MPa
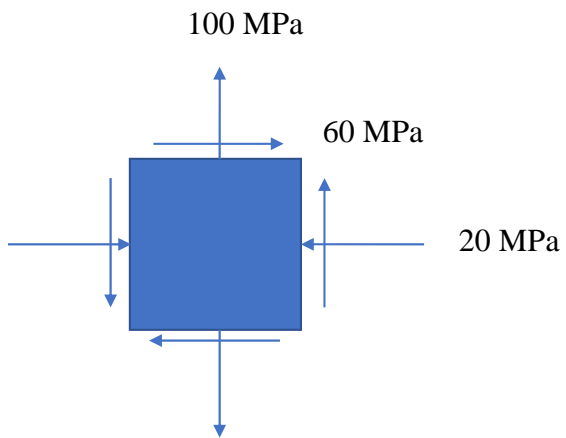
3. Consider the cantilever beam under a distributed load shown in the figure (the distribution is linear from zero at point B to w at point C). Sketch the shear (V) and bending moment (M) diagrams, and label the values of V and M at points A, B and C. Show your work.
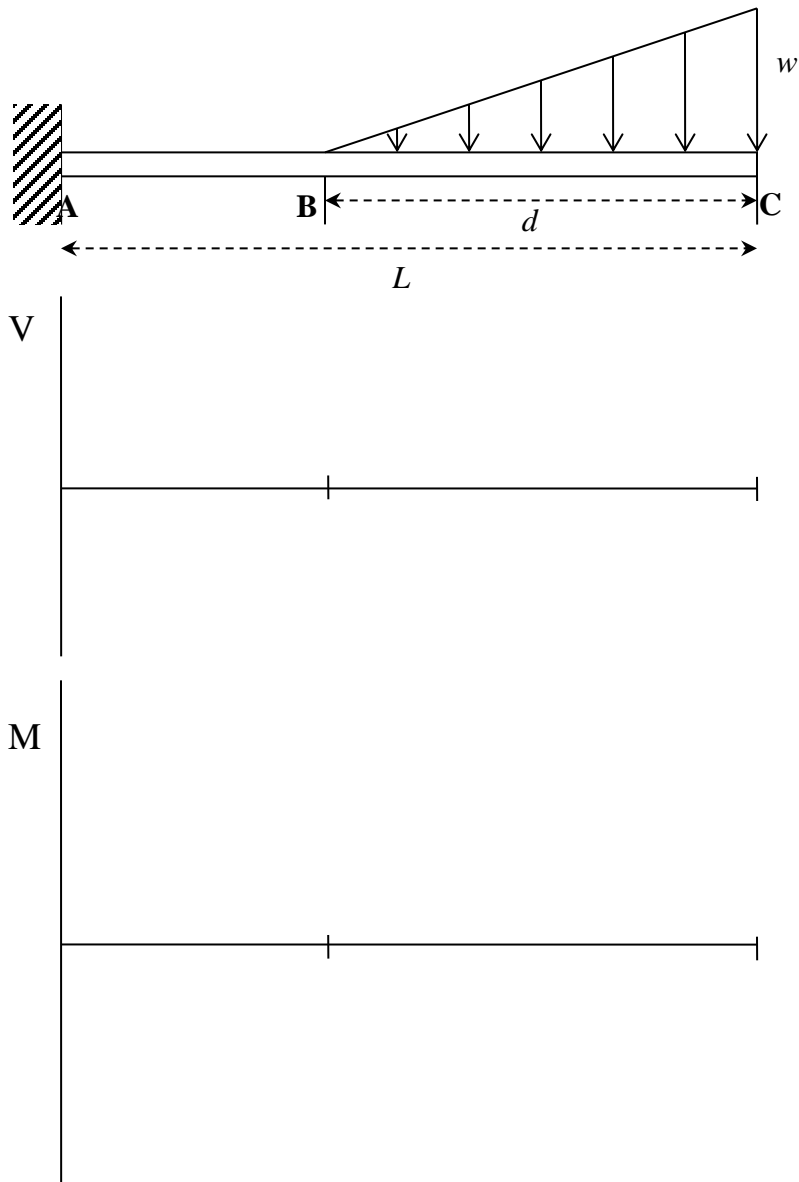
4. A rod with length L and cross section area A, is hung from a ceiling at one end. Obtain the total extension of the rod, due to its only weight W.