

Ph.D. Qualifying Examination

Mechanics of Materials

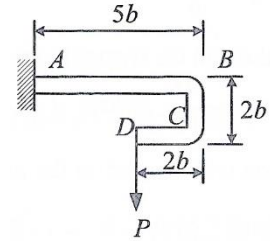
Fall 2018

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.

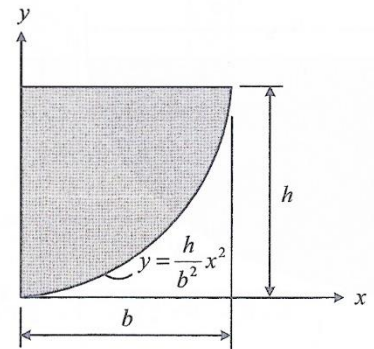
Problem 1:

The beam shown below is subject to a load P at point D . The beam has a circular cross section, with diameter d . Determine the maximum tensile stress at point A (the support end). Write your answer in terms of the given parameters P , b and d .

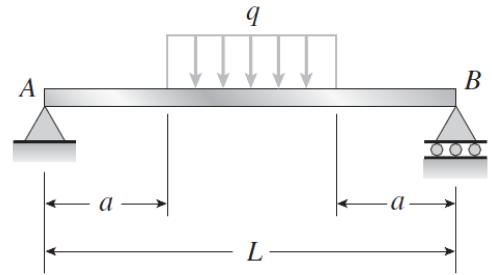


Problem 2:

Determine the moment of inertia (second moment) of the shaded area (i) about the x axis and (ii) about the y axis.



Problem 3: A simple beam AB supports a uniform load of intensity q acting over the middle region of the span. Determine the angle of rotation θ_A at the left-hand support and the deflection δ_{\max} at the midpoint.



Problem 4: An element in uniaxial stress is subjected to tensile stresses $\sigma_x = 55 \text{ MPa}$, as shown in the figure. Using Mohr's circle, determine:

(a) the stresses acting on an element oriented at an angle $\theta = -30^\circ$ from the x axis (minus means clockwise)

(b) the maximum shear stresses and associated normal stresses.

Show all results on sketches of properly oriented elements.

