Civil Engineering Licensure Exam – Mock Exam (Day 39: Combined Stresses and Mohr's Circle)

February 24, 2025

Instructions

- Time Limit: 60 Minutes
- Coverage: Combined Stresses and Mohr's Circle
- Total Questions: 10 (Multiple Choice & Problem-Solving)
- Show complete solutions for problem-solving questions.

Section A: Multiple Choice Questions (MCQs)

Choose the best answer.

1. Normal stress is given by:
   (a) $\sigma = \frac{F}{A}$
   (b) $\tau = \frac{VQ}{Ib}$
   (c) $\sigma = \frac{My}{I}$
   (d) $\sigma = \frac{P}{L}$
2. The principal stresses in a material are:
   (a) The maximum and minimum normal stresses
   (b) The maximum and minimum shear stresses
   (c) The average stress values

(d) The stresses only in the axial direction

3. The center of Mohr's Circle represents:

   (a) The average normal stress
   (b) The maximum shear stress
   (c) The bending moment
   (d) The axial force

4. The radius of Mohr's Circle represents:

   (a) The maximum shear stress
   (b) The minimum principal stress
   (c) The average normal stress
   (d) The moment of inertia

5. If a material is subjected to a pure shear stress, Mohr's Circle will be:

   (a) Centered at the origin
   (b) A point on the normal stress axis
   (c) A vertical line on the shear stress axis
   (d) A circle passing through the origin

Section B: Problem-Solving

1. A steel rod has a normal axial force of 50 kN and a cross-sectional area of 200 mm^2. Determine the normal stress in the rod.

2. A rectangular beam carries a bending moment of 10 kN·m. If the moment of inertia is 5×10^6 mm^4 and the distance to the extreme fiber is 100 mm, determine the maximum bending stress.

3. A structural element is subjected to normal stresses of $\sigma_x = 80$ MPa and $\sigma_y = 40$ MPa, with a shear stress of $\tau_{xy} = 30$ MPa. Determine the principal stresses using Mohr's Circle.

4. A material has normal stresses of 100 MPa and 60 MPa applied in perpendicular directions. Using Mohr's Circle, determine the maximum shear stress.

5. A shaft is subjected to a torsional shear stress of 50 MPa and an axial normal stress of 80 MPa. Determine the principal stresses using Mohr's Circle.