Civil Engineering Licensure Exam – Mock Exam (Day 29: Static Equilibrium and Force Systems)

February 24, 2025

Instructions

- Time Limit: 60 Minutes
- Coverage: Static Equilibrium and Force Systems
- 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. A force system is in equilibrium when:
   (a) The sum of all forces and moments is zero.
   (b) The forces are parallel.
   (c) The forces are equal in magnitude.
   (d) The system is accelerating.
2. The conditions for static equilibrium in a two-dimensional force system are:
   (a) $\sum F_x = 0, \sum F_y = 0, \sum M = 0$
   (b) $\sum F_x = 0, \sum F_y = 0, \sum F_z = 0$

(c) $\sum M_x = 0, \sum M_y = 0, \sum M_z = 0$

(d) $\sum F_x = 0, \sum F_y = 0, \sum M_z = 0$

3. The moment of a force about a point is calculated as:

   (a) $M = F \times d$

   (b) $M = F + d$

   (c) $M = \frac{F}{d}$

   (d) $M = F - d$

4. If a beam is in static equilibrium, the sum of all external forces and moments acting on it must be:

   (a) Positive

   (b) Negative

   (c) Zero

   (d) Equal to the support reactions

5. A simply supported beam has:

   (a) Two reaction forces

   (b) One reaction force

   (c) No reaction force

   (d) Three reaction forces

Section B: Problem-Solving

1. A 500 N force is applied at a 30-degree angle to the horizontal. Determine its horizontal and vertical components.

2. A beam 6 m long is simply supported at both ends. A point load of 300 N is applied at 2 m from the left support. Determine the reaction forces at both supports.

3. A force of 200 N is applied perpendicular to a lever arm at a distance of 0.8 m from the pivot. Determine the moment generated by the force.

4. A uniform beam weighing 600 N is supported at its ends and carries a 400 N load at its midpoint. Determine the reactions at the supports.

5. A structure is in static equilibrium under the action of three forces. The first force is 500 N at 0 degrees (horizontal), and the second force is 300 N at 90 degrees (vertical). Determine the magnitude and direction of the third force required to maintain equilibrium.