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END SEMESTER EXAMINATION: February – 2019 (Supplementary)

CE 7221: Earth Pressure & Earth Retaining Structure

Max Marks: 100 **Time Allowed: 3 hours**

NOTE: Attempt any FIVE questions. Marks carried by a question are indicated against it. Assume any data suitably, if missing.

1. (a) A smooth vertical wall 5 m high, supports a saturated cohesive backfill (φ=0) with horizontal surface. The top 3 m of the backfill weighs 17.6 kN/m^3, and has an apparent cohesion of 14 kN/m^2. The bulk unit weight and apparent cohesion of the bottom 2 m of the backfill are respectively 19.2 kN/m^3 and 20 kN/m^2. Determine the likely depth of tension cracks behind the wall. If tension cracks develop, what will be the total active pressure? Sketch the pressure distribution diagram and locate the point of application of the resultant pressure. **(11)**

   (b) Describe various pressure envelops used to estimate earth pressure in braced cuts. Also describe the procedure to calculate strut loads. Describe, how the pressure envelope for cuts in layered soil shall be prepared. **(9)**

2. (a) Explain "Arching in Soils". Explain Terzaghi's theory for vertical stress on an yielding long narrow strip for cohesive and cohesionless soils respectively. **(10)**

   (b) An anchored sheet pile wall penetrates pure saturated clay while the backfill is cohesionless. Draw the earth pressure diagram and analyse the stability of the wall. Also derive expression for maximum bending moment in the wall. **(10)**

3. (a) A cantilever sheet pile wall penetrates pure saturated clay while the backfill is cohesionless. Determine expressions for lateral pressure intensities at important locations and draw the earth pressure diagram. What is limiting height of the wall? Also derive expression for maximum bending moment in the wall. **(10)**

   (b) Derive the expression for coefficient of active earth pressure under Rankine conditions for a sloping backfill for a cohesionless soil. What will be the expression for passive earth pressure? **(10)**

4. (a) Derive with neat sketches the expression for coefficient of active earth pressure under generalised Coulomb's conditions. **(13)**

   (b) Describe with neat sketches various types of joints, and drainage provisions in retaining walls. **(7)**

5. (a) The height of a steel cantilever sheet pile wall above the dredge line is 5m; it retains a cohesionless soil throughout the backfill having γ=16.2 kN/m^3, and φ=33°. Determine (i) the theoretical depth of embedment, and (ii) the minimum section modulus of the sheet pile, use σ_{all} = 172 MN/m^2. **(13)**

   (b) What is lateral earth pressure at rest? Describe various expressions to determine the at-rest earth pressure coefficient. **(7)**

6. (a) The height of an anchored sheet pile wall above the dredge line is 9m, and the anchor is situated at a depth of 1.5m from top. The sheet pile is retaining a cohesionless soil throughout having γ=16.1 kN/m^3, and φ=31°. Use free earth support method to determine: (i) the theoretical depth of penetration, (ii) the anchor force, and (iii) the maximum bending moment in the sheet pile. **(12)**

(b) Classify and differentiate clearly with the help of neat sketches, the various types of underground conduits. **(8)**

7. (a) The height of an anchored sheet pile wall above the dredge line is 9m, and the anchor is situated at a depth of 1.5m from top. The sheet pile is retaining a cohesionless soil throughout having γ=17 kN/m^3, and φ=35°. Use fixed earth support method to determine: (i) the theoretical depth of penetration, (ii) the anchor force, and (iii) the maximum bending moment in the sheet pile. **(13)**

(b) Explain with neat sketches, the various types of anchors used in sheet pile walls. **(7)**
