1. Evaluate the maximum bending moment, shear force and deflection for Beam A and Beam B shown in figure below. Also report the reaction forces at the four exterior columns. **[15 M]**

Consider the following data

Beams: 230 x 450 mm
Columns: 400 x 400 mm
Slab: 150 mm thick
Parapet wall height: 1 m
Floor finish: 1 kN/m²
Water proofing: 2 kN/m²
Terrace finish: 1.5 kN/m²
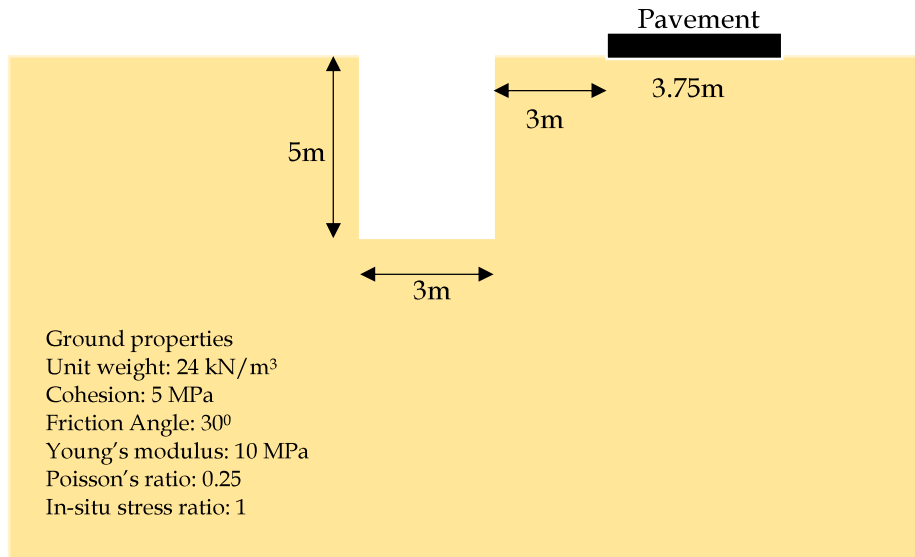Live load (inc roof): 3 kN/m²
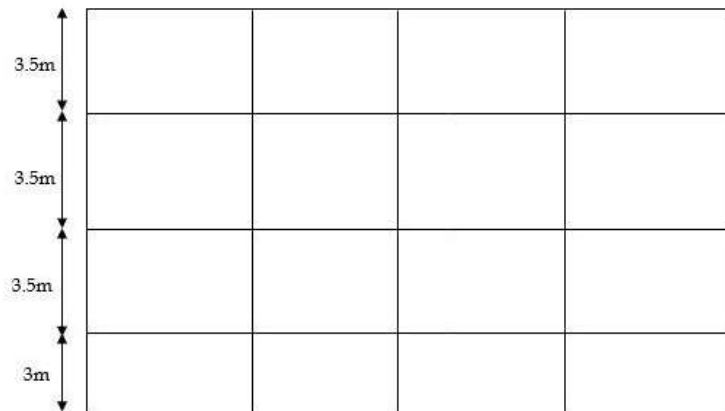
Elevation
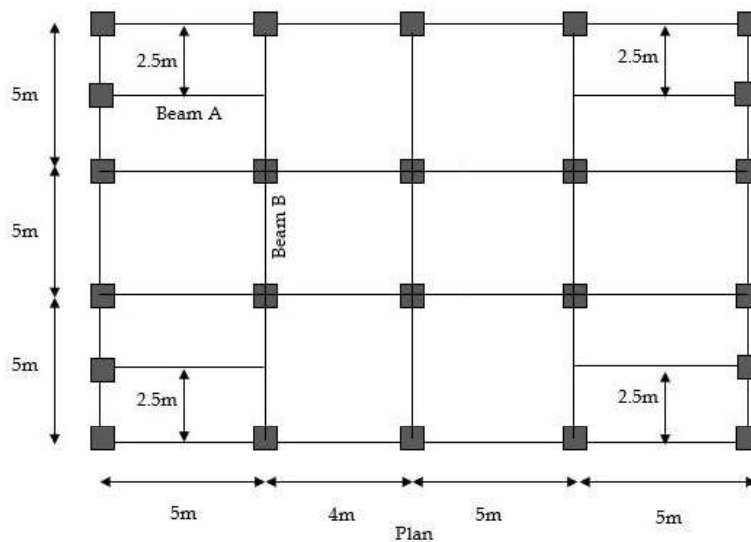
Plan

A pit is to be excavated for the purpose of constructing some civil infrastructure utilities adjacent to a road section as per the details shown in figure below. It is required to evaluate deformation along the road level as a result of the excavation. Considering the following soil conditions, evaluate the deformation.   [10 M]

Ground properties
Unit weight: 24 kN/m³
Cohesion: 5 MPa
Friction Angle: 30⁰
Young's modulus: 10 MPa
Poisson's ratio: 0.25
In-situ stress ratio: 1

3. Answer the following in detail   [2.5x4=10M]

a. Explain the concept of convergence study with respect to the optimum number and distribution of mesh for any typical civil engineering problem. Make use of neat sketches to support your answer.

b. Why is it necessary to include appropriate boundary size for a geotechnical modelling? What kind of boundary conditions would you employ for a slope stability problem?

c. Differentiate between primary and secondary beams. How do we ensure fixed end beams in a frame in field?

d. What is the importance of constitutive models in numerical analysis. Explain with an example.