Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Assume data wherever necessary.*

[1] The values of liquid limit = 60%, plastic limit = 30% and shrinkage limit = 20% of a soil were reported. If a specimen of this soil shrinks from a volume 10 cc at liquid limit to 6.1 cc at shrinkage limit, determine the Specific gravity of solids. **[5]**

[2] A single row of sheet pile is driven upto a depth of 4m in a bed of clean sand having a co – efficient of permeability of 0.002 cm/sec. An impermeable layer of very stiff clay exists at a depth of 10 m below the G.L. The sheet pile wall has to retain water upto 4m above G.L. The height of water level on the downstream side is 0.5 m. Based on the given flownet given below,

Impervious Layer
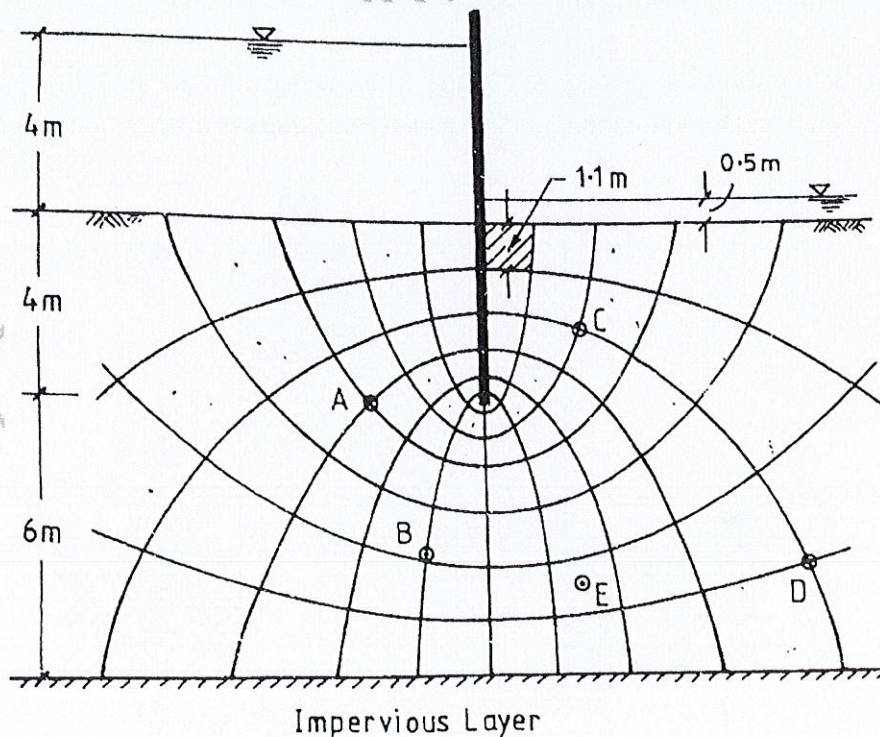
Determine:

(i) The piezometric heads at points A, B, C, D and E

(ii) Quantity of seepage **(in m³/day)** considering unit width of sheet pile

(iii) The exit gradient

(iv) Factor of safety against piping given G = 2.67 and e = 0.95   [3+3+1+1 = 8]

[3] In a shallow pond used by cattle for bathing, some cattle were lost each year whenever the pond bottom was unable to support the weight of an animal. As a consulting Geotechnical Engineer you investigated that the pond was 1 m deep. Below it was a 5m thick layer of silty fine sand having a total unit weight of 18 kN/m³. This was underlain by a layer of medium sand. The medium sand layer had pore water pressure which was observed to vary with the season as follows:

January to March	75 kN/m²
April to June	60 kN/m²
July to September	100 kN/m²
October to December	80 kN/m²

During which period is it unsafe for animals to bathe in the pond? Why?   [3]

[4] Clearly bringing out the significance, explain A-line plasticity chart for soil classification. [3]

[5] The figure below shows a set – up of a water filter. Determine the amount of water that can be filtered in a day. Draw the total, neutral and effective stress distribution diagrams.

[3 + 1 + 1 + 1 = 6]

Soil
k = 6 ×10⁻³ cm/s
n = 40%
Gₛ = 2.65

4.0 m

3.5 m

1.0 m

Area = 3.14 m²