

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination May 2019
B. Tech. in Civil Engineering, Semester VI

Roll No.....

CE608: Geotechnical Engineering – II

Time: 3 hours

Max. Marks: 60

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. In order to solve complex mathematical forms, Casio fx-991 MS or fx-991 ES or fx-991 ES Plus shall be permitted, however **programmable calculators** are strictly not entertained.
5. Students should bring their own **Formula sheets** signed by the course instructors.

Q.1A Short answer type questions (Attempt any 4 questions @ 2.5 marks each)

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Comment, validate and support your answer

- i. A consolidated undrained triaxial compression test is conducted on a sand sample at a confining pressure of 100 kPa. The deviator stress at failure is 80 kPa, the pore water pressure measured at failure is 50 kPa. The undrained angle and effective angle of internal friction of the soil is _____ and _____ (in degrees)
- ii. An unconfined compression test yielded a strength of 0.1 N/mm². If the failure plane is inclined at 50° to the horizontal, what are the values of shear strength parameters?
- iii. A retaining wall of height 8 m retains dry sand. In the initial state, the soil is loose and has a void ratio of 0.5, $\gamma=17.8$ kN/m³, $\phi=30^\circ$. Subsequently, the backfill is compacted to a state where void ratio is 0.4, $\gamma=18.8$ kN/m³, $\phi=35^\circ$. The ratio of initial passive thrust (force) to the final passive thrust (force), according to Rankine's earth pressure theory is (a) 0.38 (b) 0.64 (c) 0.77 (d) 1.55
- iv. What is the effective shear strength of a saturated soil mass whose total normal stress is 295 kPa and pore pressure is 120 kPa. The effective shear strength parameters are 12 kPa and 30°.
- v. Mention the types of Boring.

Q.2A A building has to be supported on a RC shaft foundation of dimensions 14 × 21m. The subsoil is clay, which has an average unconfined compressive strength of 15 kN/m². The pressure on the soil due to the weight of the building has provision for basement floor (s). At what depth should the bottom of the raft be placed to provide a factor of safety of 3 against shear failure?

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$\gamma_{\text{clay}} = 19$ kN/m³. Use Skempton's approach for bearing capacity calculations.

Q.2B Figure 1 shows an element 'A' at a depth (Z) below the soil surface, derive the expressions for active OR passive earth pressure with the help of Mohr circle. Assume

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the soil to be cohesionless. Also, indicate the slip plane within the soil mass near the retaining wall for the chosen case.

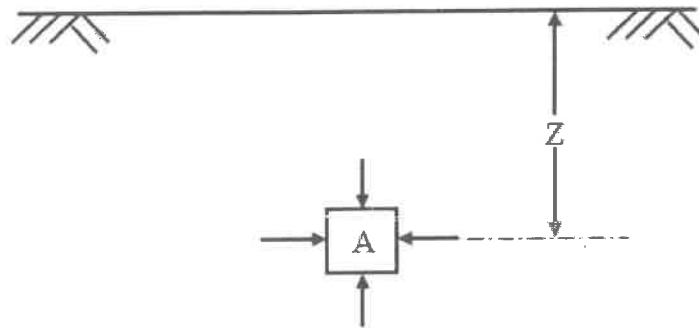


Figure 1. Soil element 'A' at depth, Z below the ground surface

Q.3A A ring footing of external diameter 8 m and internal diameter 4 m rests at a depth 2 m below the ground surface. It carries a load intensity 200 kN/m^2 . Find the vertical stress at depths of 2, 4 and 8 m along the axis of the footing below the footing base. Neglect the effect of the excavation on the stress.

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Q.3B Based on the site inspection and investigation, mention the information that are necessary for a Geotechnical Engineer to prepare the soil report. Discuss about the significance of the report in the design or construction purposes.

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OR

Q.3B For a new project related to construction of significant structure, discuss about the investigation that is carried by Civil/Geotechnical Engineer to gather knowledge about the nature of soil for safe and economic design of the structure. Also, mention the stages involved in this process.

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Q.4A A concrete dam is constructed across a river over a permeable stratum of soil of limited thickness. The water heads are upstream side 16m and 2m on the downstream side. The flow net constructed under the dam gives $N_f = 4$ and $N_d = 12$.

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Calculate the seepage loss through the subsoil if the average value of the hydraulic conductivity is $6 \times 10^{-3} \text{ cm/sec}$ horizontally and $3 \times 10^{-4} \text{ cm/sec}$ vertically. Calculate the exit gradient if the average length of the last field is 0.9 m. Assuming $e = 0.56$, and $G_s = 2.65$, determine the critical gradient. Comment on the stability of the river bed on the downstream side.

Q.4B A concrete strip footing rectangular in cross section is located at ground level and extends 1.2 m below the ground level. It carries UDL of 15000 kg/m . The soil profile consists of homogenous clay 6 m thick overlying rock. The clay properties are as under:

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Saturated unit bulk weight = 1750 kg/m^3

Shear strength (undrained) = 8500 kg/m^2

Compressibility = $1 \times 10^{-4} \text{ m}^2/100 \text{ kg}$

Determine ,

(i) Width of footing for factor of safety, $F = 2$

Assume bulk unit weight of concrete = 2500 kg/m^3

Neglect the spread of load beneath the footing and any side cohesion on the foundation.

- Q.5A Figure 2 shows a 3-layered backfill behind a 15 m high retaining wall with a smooth vertical back. Draw the active earth pressure distribution along the depth of retaining wall. 05

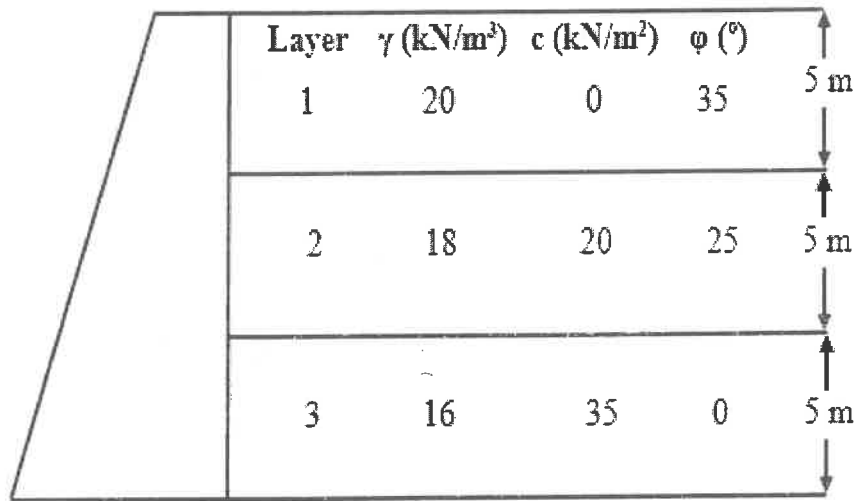
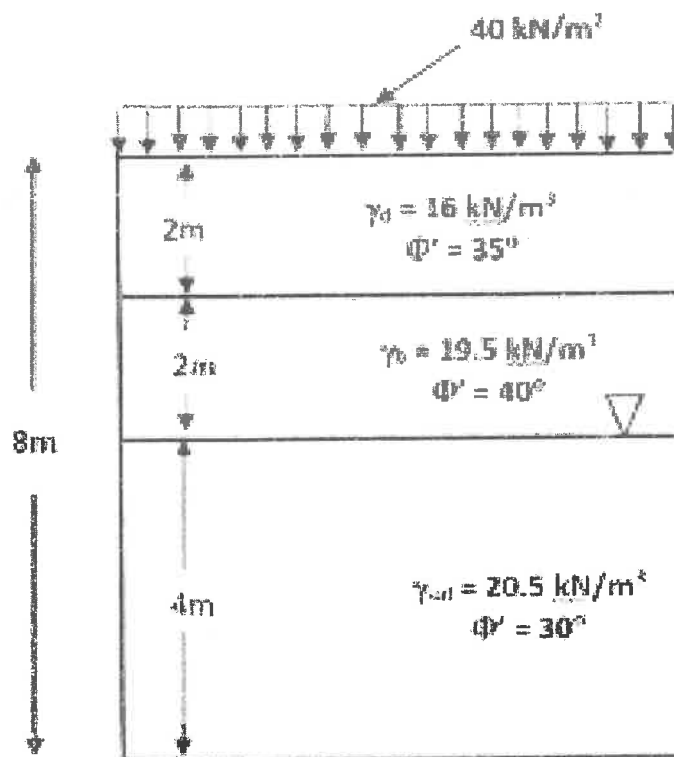


Figure 2. Retaining wall with backfill

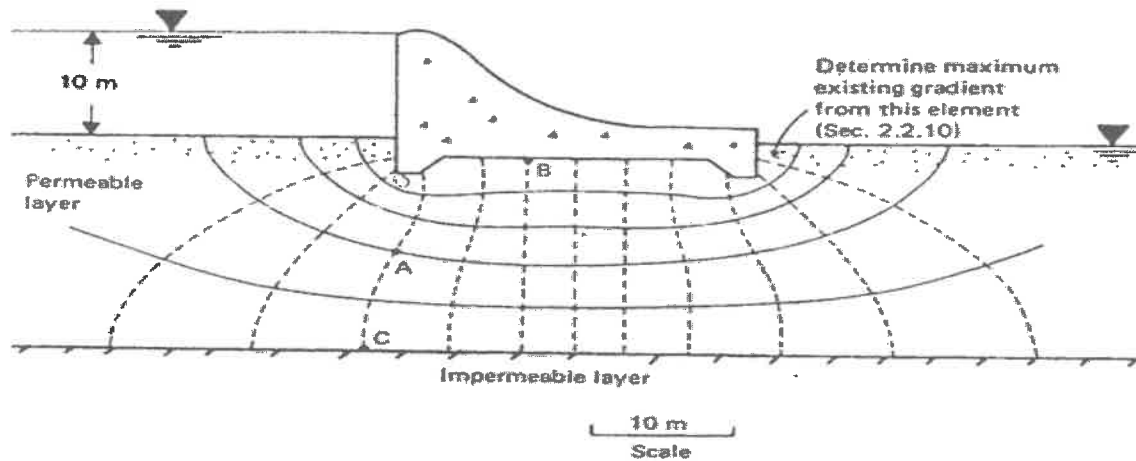
- Q.5B For the retaining wall shown in figure, draw the active earth pressure distribution diagram and obtain total active force on the wall. 05



- Q.6A A square footing is required to carry a net load of 1200 kN. Determine the size of the footing if the depth of foundation is 2 m and tolerable settlement is 40 mm. The soil is sandy with $N=12$ and $FOS=3$. Water table is very deep. Use Teng's equation. 05

Q.6B For the Flow rate net as given in figure :

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How high would water rise if a piezometer is placed at (i) A, (ii) B, (iii) C?
If $K = 0.01 \text{ mm/s}$, determine the seepage loss of the dam in $\text{m}^3/(\text{day} \cdot \text{m})$

OR

Q.6B A water tank is supported by a ring foundation having outer diameter of 10 m and inner diameter of 7.5 m. The ring foundation transmits uniform load intensity of 160 kN/m^2 . Compute the vertical stress induced at a depth of 4 m. below the centre of ring foundation, using (a) Boussinsq analysis and (ii) westergrade analysis taking $\mu = 0$.

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