B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E.   Semester: V
Branch: CIVIL ENGINEERING   Duration: 3 hrs.
Course Code: 20CV5PCGTE   Max Marks: 100
Course: Geotechnical Engineering - II   Date: 30.09.2023

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data if any, may be suitably assumed.
3. Draw sketches wherever necessary.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) Explain Normally consolidated and over consolidated clays. Describe with a neat sketch Casagrande method to determine pre consolidation pressure. **10**

   b) A 5 m thick soft NC clay layer exists below ground surface with water content = 30%. The properties of clay layer are: $\Upsilon_{sat} = 19kN/m^3$, specific gravity G= 2.70, Liquid limit = 62%. A foundation load will subject the centre of the clay layer to a vertical stress increment of 35kpa. Water table is located at ground surface. Compute: **10**
      a) Compression index, void ratio, initial effective stress in clay layer.
      b) Consolidation settlement at the centre of the clay layer.
         Sketch the given profile

OR

2 a) Explain with a sketch Square root t method to find coefficient of consolidation. **10**

   b) Plot e-log P curve for the data given below: **10**
   Determine Compression index. Also find coefficient of volume change between the pressures 50kpa and 100kpa.

Effective pressure kPa	6.25	12.5	25	50	100	200	400	800
Void ratio, e	1.590	1.585	1.575	1.550	1.500	1.445	1.390	1.335

UNIT - II

3 a) List the assumptions and limitations of Rankine Earth pressure theory. **05**

b) A retaining wall with smooth vertical back retains a purely cohesive soil (ϕ_u=0). **05**
Height of the wall =12m, unit weight of backfill = 20kN/m^3, C= 10kpa.
Determine

    i) Depth of tension cracks

    ii) Critical depth of a vertical cut

    iii) Active earth pressure before formation of tensile crack. Sketch the
    pressure diagram.

c) A retaining wall 5m high with vertical back (θ =0) supports c=0 soil with unit **10**
weight = 16kN/m^3. The ground surface is inclined at 10 degrees to horizontal
from the crest of the wall. If angle of internal friction ϕ = 30 degrees and angle
of wall friction δ = 20 degrees, Determine Total active Earth pressure per m of
the wall graphically by **Rebhann's** graphical method.

Mark the direction of P_a and its point of application. Indicate the failure surface.

UNIT - III

4 a) Mention any i) Two major forces causing instability of slopes and **05**
              ii) Three remedial measures for improvement of slope stability.

b) Discuss Fellinous method to find the centre of critical slip circle. **05**

c) A vertical cut is made in a clay deposit having γ = 16kN/m^3, c= 30kPa, ϕ =12 **05**
degrees. Find the maximum height of cut which can be temporarily supported.

For i=90	Φ=0	Φ=5	Φ=10	Φ=15
S_n	0.261	0.239	0.218	0.199

d) In order to find the factor of safety of d/s slope of an earthen dam, during steady **05**
seepage, the section of the dam was drawn to a scale of 1cm = 4m and the
following results were obtained on a critical slip circle.

Area of N-rectangle = 14.4cm^2.

Area of T-rectangle = 6.4cm^2.

Area of U-rectangle = 6.9cm^2.   Length of arc = 12.6 cm.

Laboratory tests have furnished values of 25degree for effective angle of shear
resistance and 30kN/m^2 for cohesion. Determine the factor of safety of the slope.
Take γ= 20kN/m^3.

UNIT - IV

5 a) Define with a neat sketch Area ratio, Inside clearance and outside clearance of a **05**
sampler along with its specifications to extract an undisturbed sample.

b) During sub surface investigation for design of foundations for a multi-storeyed **05**
building project, a SPT was conducted at 4.5m below ground surface. The record
of number of blows is given in the following table. Assuming water table at
ground level, soil as fine sand, and correction for overburden as =1, Determine
the corrected N value.

Penetration depth, cm	No. of blows
0 – 7.5cm	3
7.5 -15cm	3
15 – 30cm	12
30 -45cm	15

c) A rectangular footing of area 3.4m x 2.4m carries a load of $320 kN/m^2$. Calculate the vertical stress at 2m depth. **10**
   i) Beneath the centre of loaded area.   ii) Beneath one of the corners.
   Adopt Equivalent Point load approximation.

OR

6 a) Explain briefly Isobars and their uses. **05**

b) A long strip footing of 2m width carries an udl of 400 kN/m. Determine the vertical stress at a depth 3m beneath the center of the strip footing. **05**

c) A seismic refraction test was conducted and arrival time of P waves were recorded by geophones kept over given range of distance from source. Estimate only P wave velocity in m/s as well as layer thickness. **10**

Distance, m	0	5	10	20	40	60	80	100	120
Time , sec	0	0.011	0.026	0.049	0.065	0.071	0.076	0.083	0.088

UNIT - V

7 a) Differentiate Local shear and General shear failure of soils. **05**

b) Discuss bearing capacity equations with water reduction factors for a strip footing in a cohesive soil when **05**
   i) Water table is at ground surface and   ii) Water table at base of footing along with neat sketches.

c) Determine the size of a Square footing resting on sand with c=0, $\phi = 30$ degrees to carry a Safe Load of 600kN. Assume F= 2.50, Unit weight of sand = $15 kN/m^3$, Depth of footing =2m. Water table is very deep. **10**
   Adopt $N_c = 37.2$ $N_q = 22.5$, $N_\gamma = 19.7$

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