University of Mumbai

Civil Engineering Examination

Sub: CEC502/ Geotechnical Engineering-I   **Year/Sem:- TE/ V Sem**

Max. Marks: 80   **Duration: - 2Hrs**

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Q1. Attempt all the MCQS   **(20 X 2 mark = 40 marks)**

1. Accurate determination of water content, is made by_____
   a) calcium carbide method
   b) oven-drying method.
   c) sand bath method
   d) alcohol method

2. Toughness index is the ratio of
   a) flow index and plasticity index
   b) plasticity index and flow index
   c) liquidity index and flow index
   d) flow index and liquidity index

3. As per ISCS, the term OH stands for
   a) Organic Silt of high compressibility
   b) Inorganic Silt of high compressibility
   c) Inorganic Silt of medium compressibility
   d) Organic Clay of high compressibility

4. The co-efficient of permeability of fine sand is _____
   a) 1.0 and greater
   b) 1×10^{-6} and smaller
   c) 1×10^{-2} to 5×10^{-3}
   d) 5×10^{-2} to 1×10^{-3}

5. According to theory of flow of fluids through porous medium, the saturated porous medium is
   a) Compressible
   b) Incompressible
   c) Moderately compressible
   d) Highly compressible

6. What is the critical gradient of a sand deposit of specific gravity = 2.65 and void ratio = 0.5?
   a) 1.0
   b) 1.05
   c) 1.10
   d) 1.15

7. What will be the hydrostatic pressure in (%) if, hW = 30 % and z = 10 %?
   a) 30
   b) 10
   c) 40

d) 50

8. The compaction energy used for standard proctor test is
   a) **592 kJ/m³**
   b) 300 kJ/m³
   c) 665 kJ/m³
   d) 1000 kJ/m³

9. The modified compactor test is also known as
   a) Standard compactor test
   b) Dietert test
   c) CBR Test
   d) **AASHTO test**

10. If the volume of voids is equal to the volume of soil solids, then the values of porosity and void ratio are respectively
   a) 0 and 0.5
   b) 0 and 1
   c) **0.5 and 1**
   d) 1 and 0.5

11. Which of the following type of soil is transported by gravitational force?
   a) Loess
   b) **Talus**
   c) Drift
   d) Dune sand

12. In sedimentation analysis, the soil fraction should be of what micron size, so as to be kept in a liquid medium (water).
   a) **75**
   b) 83
   c) 70
   d) 50

13. A natural soil deposit having water content 15%, specific gravity 2.50 and void ratio 0.5, Calculate Degree of Saturation
   a) 50%
   b) 60%
   c) **75%**
   d) 80%

14. If plasticity index is between 4%-7%, then as per plasticity chart soil may be classified as
   a) CL – OL
   b) **CH - OH**
   c) **CL-ML**
   d) CL- OI

15. What will be effective stress of a soil mass is $\Upsilon = 20$ kN/m³, $D_f = 2$m and u = 15 kN/m²
   a) 15
   b) **25**
   c) 35

d) 55

16. For pile foundations, the depth of exploration at the start of the work is _____
    a) 10m
    b) 40m
    c) 70m
    d) 200m

17. The average permeability of the deposit in horizontal direction is computed using
    a) $K_H = \dfrac{K_1H_1+K_2H_2+K_3H_3}{H_1+H_2+H_3}$
    b) $K_H = \dfrac{H_1+H_2+H_3}{\frac{H_1}{K_1}+\frac{H_2}{K_2}+\frac{H_3}{K_3}}$
    c) $K_H = \dfrac{H_1+H_2+H_3}{K_1H_1+K_2H_2+K_3H_3}$
    d) $K_H = \dfrac{\frac{H_1}{K_1}+\frac{H_2}{K_2}+\frac{H_3}{K_3}}{H_1+H_2+H_3}$

18. Thick wall samplers have area ratio_____
    a) greater than 20 -35%
    b) greater than 10- 25%
    c) lesser than 10 -25%
    d) lesser than 15 -35%

19. The phenomenon of regaining of lost strength with passage of time under constant water content is called
    a) Thixotrophy
    b) Liquefaction
    c) Sensitivity
    d) plasticity

20. In falling head permeability test, change in the head at a time interval dt is denoted as
    a) dh
    b) –dh
    c) h
    d) -h

Q2. Attempt any FOUR   **(04 X 05 marks = 20 marks)**

1. Prove that $\gamma_d = (1-n_a)*G*\gamma_w/(1+w*G)$ showing usual notations.

2. The Atterberg limits of a clay soil are: Liquid limit = 75%; Plastic limit = 45%; and Shrinkage limit = 25%. If a sample of this soil has a volume of 30 cm^3 at the liquid limit and a volume 16.6 cm^3 at the shrinkage limit, determine the specific gravity of solids.

3. Write in detail about effect of compaction on soil properties.

4. Explain the factors affecting permeability of soil.

5. What is flownet? What are the characteristics of flownet?

6. A bed of sand consists of three horizontal layers of 2.5m thickness. The magnitude of co-efficient of permeability for both upper and lower layers is 5 x 10^{-4} m/s and for middle

layer it is 6×10^{-3} m/s. What is average permeability of bed in horizontal to that of vertical direction?
7. Write a short note on quick sand condition.
8. Write in short about bore hole logs.

Q3. Attempt any TWO   **(02 X 10 marks = 20 marks)**

1. A soil is to be excavated from a borrow pit which has a density of 1.75gm/cc and w = 12% and G = 2.7. The soil is compacted to water content of 18% and dry density of 1.65gm/cc. Hence for 1000 m^3 of soil in the fill, estimate:
   - Quantity of soil to be excavated from pit in m^3
   - Amount of water to be added in tons.
2. There are 2 Borrow Area A & B which have soil with void ratio of 0.8 and 0.7 resp. The in-place water content is 20 % and 15 % resp. The fill at the end of the construction will have the volume of 10000 m^3, Υ = 2 Mg / m^3 and placement water content is 22%. Determine the volume of the soil to be excavated from both the area as G = 2.67 the cost of excavation and transportation for A is Rs. 200 / 100 m^3 and Rs. 220 / 100m^3 for borrow pit B. State which borrow pit is economical.
3. Calculate the coefficient of permeability of a soil sample 6cm in height and 50cm in c/s area, if quantity of water equal to 430ml passed down in 10 minutes, under effective constant head of 40cm. On oven drying the test specimen has mass of 498g. Taking specific gravity of soil solids as 2.65, calculate seepage velocity of water during test.
4. A granular soil deposit 8m deep over an impermeable layer. The ground water table is 4m below ground level. The deposit has a zone of capillary rise of 2m with a saturation of 50%. Plot the variation of total, pore water and effective pressure diagram with e = 0.6 and G = 2.65.
5. A pumping out test was carried out in the field in order to determine the average coefficient of permeability of 18m thick sand layer. The ground water table is at a depth of 2.2m below the ground level. A steady state was reached when the discharge from the well was 21.5lt/sec. A this stage the drawdown in the test well was 2.54m while the drawdown in the two observation wells situated at 8m and 20m from the test well were found to be 1.76m and 1.27m respectively. Find coefficient of permeability and radius of influence.