B.E. (Civil Engineering) Fourth Semester (C.B.S.)

Geotechnical Engineering - I

P. Pages : 3 **NIR/KW/18/3349**

Time : Three Hours * 1 2 9 5 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Discuss the origin of soil. Enumerate the major deposits found in India. **6**

b) A moist sample of soil has a mass 633 gms has a volume of 300 cm^3 at a water content of 11%. **7**

Taking G = 2.68, determine e, Sr, η and ηa. Also determine the water content at which the soil gets fully saturated without any increase in the volume. What will be the unit weight of soil at saturation.

OR

2. a) Derive, from the first principles; **6**

W.G = e. Sr

b) A partially saturated sample of soil from an earth fill has a natural moisture content 20% and bulk unit weight of 2.0 gms per cc. Assuming specific gravity of solids as 2.7 and density of water as 1 gm per cc. Compute its degree of saturation and voids ratio of subsequently the soil gets saturated, determine its unit weight. **7**

3. a) Determine the value of Liquid limit of a soil from following test data:- **7**

No. of flows (N)	38	34	20	12
Water content (%)	16	17	20	22

Find also plasticity Index, if plastic limit is 14%.

b) Write a note on Textural classification of soils. **6**

OR

4. a) Define water content of soil. Enlist various methods of water content determination and discuss any one in detail. **6**

b) Determine flow index, liquidity index and consistency Index, if LL = 65%, PL = 35%, natural water content = 45% and given that at water content of 32% the no. of flows in liquid limit test were 48. **7**

5. a) What are the factors affecting permeability of soil. **7**

b) Find the average of horizontal and vertical permeabilities of a soil mass made up of three horizontal layers. The first and second layers have the same thickness of 0.5 m each. The third layer is 1.2m thick. The coefficient of permeabilities of the first, second and the third layers are respectively $1x10^{-3}$ cm/sec, $2x10^{-2}$ cm/sec and $5x10^{-4}$ cm/sec. **7**

OR

6. a) Explain the applications of flow net. **7**

b) The flow net for a sheet pile driven in a sandy silt gave number of flow channels $N_F = 3$, and number of potential drops $N_d = 9$. The size of the smallest field on the exit face was found to be 1.5m x 1.5m. If the effective head lost is 7.5m, determine the factor of safety against piping for e = 0.7, G = 2.65. **7**

7. a) Explain stress isobar and vertical pressure distribution on a horizontal plane. **6**

b) Find the intensity of vertical pressure and horizontal shear stress at a point 4m directly below a 20 kN point load acting at a horizontal surface. What will be the vertical pressure and shear stress at a point 2m horizontally away from the axis of loading but at the same depth of 5m? **7**

OR

8. a) Explain the construction of and use of Newmark's Influence Chart. **6**

b) A uniformly loaded rectangular area 2.0m by 3.0m has a loading intensity of 200 kN/m^2. Calculate the component of vertical stress at a depth of 3.0m below the centre and at the corner of loaded area by equivalent point load method. **7**

9. a) A clay layer, whose total settlement under a given loading is expected to be 12 cm settles 3am at the end of 1 month after the application of load increment. How many months will be required to reach a settlement will occur in 10 months? Assume the layer to have double drainage. **7**

b) Describe the square root of time fitting method to find coefficient of consolidation. **6**

OR

10. a) State the factors affecting compaction. **6**

b) Following observations were made in a standard proctor test. **7**

W(%) =	13.5	20.2	28.9	36.7	41.5
Y (kN/m^3) =	16.3	19.4	19.7	18.2	17.2

Calculate OMC & Max. Dry Density.
If the field density of the compacted layer is found to be 19.5 kN/m^3 at water content of 20%. What is the relative compaction?

11. a) A specimen of clean, dry, cohesionless sand is tested in shear box and the soil failed at a shear stress of 40 kN/m^2 when the normal load on the specimen was 50 kN/m^2. Determine:- **8**

a) The angle of shearing resistance,

b) The principal stress during the failure,

c) The directions of the principal planes with respect to the direction of the plane of shearing.

b) How shear strengths tests are classified on the basis of consolidation and drainage condition of soil. Discuss any one test in brief. **6**

OR

12. a) Explain in brief "Triaxial shear test". **6**

b) Three clay specimens, having a small air-void content were tested in a shear box under undrained conditions and the following observations were made:- **8**

Normal Stress (kN/m^2)	100	200	300
Shear stress (kN/m^2) cat failure	90	102	108

Find the shear parameters.

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B.E. (Civil Engineering) Fourth Semester (C.B.S.)

Geotechnical Engineering - I

P. Pages : 3 **NJR/KS/18/4404**

Time : Three Hours * 0 7 6 5 * Max. Marks : 80

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7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Derive the equation relating saturated unit weight (γ_{sat}), specific gravity (G), void ratio (e) from the basic principles. **7**

b) Write short notes on formation of soil. **6**

OR

2. a) A natural soil deposit has a bulk unit weight $18\,kN/m^3$ and water content of 5%. Calculate the amount of water required to be added to $1m^3$ of soil to raise water content to 16%. What will be the degree of saturation? Assume G = 2.65 and void ratio remains constant. **7**

b) Determine the maximum possible void ratio for uniformly graded sand having perfectly spherical grains. **6**

3. a) Following are the test results of liquid limit performed on a fine grained soil **7**

Number of blows	Water content (%)
37	39
31	42
21	48
17	52
13	57

Determine the consistency index and plasticity index if natural moisture content of the soil is 19% and plastic limit is 21%.

b) Explain with help of sample graph the following terms: **6**
a) Well graded soil.
b) Gap graded soil
c) Uniformly graded soil

OR

4. a) Explain unified soil classification system with the help of plasticity chart. **6**

b) An undisturbed saturated specimen of clay has a volume of 20cm^3 and a mass of 31.0 g. On oven drying the mass reduces to 19.0 g. The volume of dry specimen as determined by displacement of mercury is 9.9cm^3. Determine shrinkage limit, specific gravity and shrinkage ratio. **7**

5. a) The data given below relate to falling head permeability test performed on soil:- Stand pipe diameter 12.5mm; Permeameter sample area 500mm^2; Permeameter sample height 60 mm; Initial head in the stand pipe 1000 mm; Final head in the stand pipe 200 mm and Time for decreasing water head 250 sec. Calculate the permeability of soil. **7**

b) Explain factors affecting permeability of soil. **7**

OR

6. a) Explain the phenomenon of quick sand condition and derive the expression for critical hydraulic gradient. **8**

b) What is a flow net? Explain its application. **6**

7. a) Explain the following. **6**
i) Pressure bulb
ii) Vertical pressure distribution on horizontal plane and
iii) Vertical pressure distribution on vertical plane.

b) A rectangular area of 2m x 4m carries a uniformly distributed load of 100 kN/m^2 at the ground surface. Calculate the vertical pressure at depth of 8m vertically below the top right corner of the loaded area. **7**

OR

8. a) Explain Newmark's influence chart. **6**

b) Derive equation for vertical pressure at center of circular area loaded with load intensity 'q'. **7**

9. a) What are the factors affecting compaction. **6**

b) Following observation were made in standard proctor compaction test. **7**

S. No.	Weight of compacted wet soil (kg)	Water content (%)
1.	1.70	7.7
2.	1.89	11.5
3.	2.03	14.6
4.	1.99	17.5
5.	1.96	19.7
6.	1.92	21.2

Determine the maximum dry density and optimum moisture content. Volume of the mould 950cm^3 and specific gravity 2.65. Also plot zero air void line.

OR

10. a) Define coefficient of consolidation. Explain the procedure to find coefficient of consolidation by Taylor's square root time fitting method. **6**

b) An undisturbed sample of clay 25cm thick consolidated to 50% in 20 minutes when tested in a laboratory with double drainage. How much time will the 5m thick clay layer represented by above mentioned sample take to drain same degree of consolidation when (a) clay layer underlined by impervious stratum and (b) clay layer has double drainage at top and bottom. **7**

11. a) How shear strengths tests are classified on the basis of consolidation and drainage condition of the soil. Discuss any one test in brief. **6**

b) A soil has angle of internal friction 30^{o} and cohesion 50 kN/m^2. Draw Mohr's circle of failure if the soil is tested in shear box at normal stress of 50 kN/m^2. Calculate magnitude and direction of principal stresses. Also, calculate the shear stress at failure. **8**

OR

12. a) Derive the relationship between major and minor principal stresses. **6**

b) Two identical specimen of a soil failed under a deviator stress of 250 and 400 kN/m^2 at corresponding cell pressure of 100 and 200 kN/m^2 respectively in a triaxial test. Determine the shear parameters. **8**

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B.E. (Civil Engineering) Fourth Semester (C.B.S.)

Geotechnical Engineering - I

P. Pages : 2 **NRJ/KW/17/4404**

Time : Three Hours * 0 1 5 7 * Max. Marks : 80

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7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.

1. a) Write short note on Formation of soil. **6**

b) A partially saturated soil from an earth fill has a natural water content of 19% and bulk unit Weight of 19.33 kN/m^3. Assuming the specific gravity of soil solid as 2.6, compute the degree of saturation and void ratio if subsequently the soil gets saturated, determine the dry unit weight and saturated unit weight. **7**

OR

2. a) A soil sample from field has a volume of 400 cm^3 and a weight of 450 gm. The water content of soil is 11% and G= 2.62. Find void ratio, degree of saturation and porosity. **7**

b) Derive the relationship $\rightarrow Y = \frac{(G + esr)Yw}{1+C}$ **6**

3. a) Explain the use of plasticity chart for classification of soils. **6**

b) The following is the result of a liquid limit test: Determine the liquid limit of a soil. If the plastic limit of the soil is 23% Find out the flow index. Natural water content were 18% Find consistency Index & liquidity Index. **8**

Number of blows	Water content
50	34.1
35	39
26	42
20	47
15	53
10	60

OR

4. a) The plastic limit and liquid limit of a soil are 30% and 42% respectively. The percentage volume change from the liquid limit to dry state is 35% of the dry volume. Similarly, the percentage volume change from the plastic limit to dry state is 22% of the dry volume. Determine the shrinkage limit and shrinkage ratio. **7**

b) Enlist Different methods of determination of water content. Explain any three in detail. **7**

5. a) What will be the ratio of average permeability in horizontal direction to that in the vertical direction for a soil deposit consisting of three horizontal layers, if the thickness and permeability of the second layer are twice of those of the first and those of the third layer twice those of second? **7**

b) Explain different factors which affecting the permeability of soil. **6**

OR

6. a) Explain 'Quick Sand Condition'. Derive the equation for critical hydraulic gradient. **7**

b) Write a short note on properties of flow net. **6**

7. a) Write short note on. **6**
i) Stress isobar.
ii) Vertical pressure distribution on horizontal plane.

b) A footing size 4m X 4m carries a uniformly distributed load of 150kN/m^2. Compute vertical pressure at a depth of 6m below the center and corner of the loaded area by equivalent point load method. **7**

OR

8. a) Explain the construction and use of Newmark's influence chart. **6**

b) A concentrated load of 1000 kN is applied at the ground surface. Compute the vertical pressure. **7**
i) At a depth of 4m below the load.
ii) At a distance of 3m at the same depth.

9. a) Explain different factors affecting compaction of soil. **6**

b) Determine maximum dry density and the optimum moisture content, with the following data of compaction test on a soil. Volume of mould = 1000 cm^3. G = 2.7. **7**

Water Content (w) %	10	12	14.3	16.1	18.2
Weight of compacted sample (N)	18.88	20.55	21.09	20.85	20.30

OR

10. a) Explain: **6**
i) Coefficient of compressibility.
ii) Coefficient of volume change.
iii) Compression index.

b) In the laboratory test on a clay sample of thickness 25 mm drained at top only, 50% consolidation occurred in 11 minutes. Find the time required for the corresponding clay layer in the field, 2m thick and drained at top and bottom to undergo 70% consolidation. Assume T50 = 0.197 and T70=0.405 **7**

11. a) Explain Mohr-Coulomb theory for shear strength of soil. **7**

b) If the major & minor principal stresses on a specimen of soil at the instant of failure are 500 kN/m^2 &150kN/m^2 respectively. Calculate the values of normal & shear stress on a plane inclined at an angle of 65° with major principal plane. **7**

OR

12. a) Enlist the various shear test depends upon drainage condition and explain vane shear test in detail. **7**

b) An unconfined compression test was conducted on a disturbed sample of clay. The sample had a diameter of 37.5 mm and was 80 mm long. The load at failure measured by the proving ring was 28 N and the axial deformation of sample at failure was 13 mm. Determine the unconfined compressive strength and the undrained shear strength of clay. **7**

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B.E. Fourth Semester (Civil Engineering) (C.B.S.)

Geotechnical Engineering - I

P. Pages : 3 **NKT/KS/17/7264**

Time : Three Hours * 0 4 9 6 * Max. Marks : 80

Notes :
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7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Diagrams and chemical equations should be given whenever necessary.

1. a) Write a short note on formation of soil giving names of soil on basis of mode of deposition. **6**

b) A natural deposit a bulk unit weight of 18.44 kN/m^3 and water content of 5%. Calculate the amount of water required to be added to 1 cubic meter of soil to raise the water content to 15%. Assume the void ratio to remain constant. What will then the degree of saturation? Assume G = 2.67 **7**

OR

2. a) Derive the relation $\gamma_d = \frac{G. \times \gamma_w}{1+e}$ **6**

b) A soil in it's natural state has, when fully saturated, a water content of 32.5%. Determine the void ratio, dry and total unit weights. Calculate the total weight of water required to saturate soil mass of volume 10 m^3. Assume, G = 2.69. **7**

3. a) Define Consistency Index & explain it. **6**

b) A test for determination for liquid limit was carried out on a soil sample. The following tests of observation were taken. Determine liquid limit & flow index. **7**

No. of Blows (N)	Water content (%)
38	47.3
27	49.6
20	53
13	55

OR

4. a) Explain the use of particle size distribution curve. **6**

b) Define : **7**

i) Effective Diameter
ii) Coefficient of uniformity
iii) Coefficient of curvature

if, D_{10} = 0.16 mm, D_{30} = 0.19 mm and D_{60} = 0.22 mm

Calculate :

i) Coefficient of uniformity and coefficient of curvature.
ii) Classify the type of soil.

5. a) Discuss various factors affecting permeability of soil. **6**

b) The following data was recorded in a constant head permeability test : **7**

i) Diameter of sample = 75 mm
ii) Head loss in a length of 180 mm = 247 mm
iii) Quantity of water collected in 60 sec = 626 ml
iv) Void ratio = 0.785

Calculate coefficient of permeability of soil. Also determine discharge and seepage velocities.

OR

6. Write a short note **any three.** **13**

i) Application of flownet

ii) Quick sand condition.

iii) Darcy's law & it's validity.

iv) Soil structure

v) Remedial measure to reduce seepage pressure in hydraulic structures.

7. a) Discuss assumption and limitations of Boussinesq approach as applied for determination of stresses induced in a soil mass due to surface loading. **6**

b) A point load of 5 tonnes acts on the surface of ground. Calculate the vertical pressure due to this load at depths of 5.00 & 6.00 m at 3.00 m Horizontally away from the axis of loading in both the cases. **7**

OR

8. a) Write a short note on followings : **6**

i) Stress isobar.

ii) Vertical pressure distribution of horizontal plane.

iii) Vertical pressure distribution on vertical line.

b) A uniformly loaded rectangular area 2 x 3 m has a loading intensity of 200 kN/m^3. Calculate the component of vertical stress at a depth of 3 m below the centre and at the corner of loaded area. **7**

9. a) State the equation for final consolidation settlement & explain the terms in this equation. **6**

b) In a laboratory consolidation test a 25 mm thick sample takes 60 minutes to reach 50% consolidation. How much time will be a 4.5 m thick layer of clay in the field required to attain - (i) 50% (ii) 90% consolidation if it can drain both at top & bottom. **8**

OR

10. a) State the factors affecting compaction of soil. **6**

b) Following are the results of a compaction test : **8**

Wt. of mould + wet soil (grams)	2925	3195	3150	3125	3070
Water content (%)	11.0	13.0	15.3	16.2	18.4

volume of the mould = 1000 c.c.
Wt. of mould = 1000 grms
Sp. Gravity of soil solids = 2.7
Find :

i) OMC and y_d max .

ii) Plot zero air void line

iii) Degree of saturation at γ_d max .

11. a) Using a Mohr's diagram drive a relationship between major & minor principal stress in a terms of shear parameters. **7**

b) If the major & minor principal stresses on a specimen of soil at the instant of failure are 500 kN/m^2 & 150 kN/m^2 respectively. Calculate the values of normal & shear stress on a plane inclined at a angle of 65° with major principal plane. **7**

OR

12. a) Explain what is meant by sensitivity of soil. How soil are classified on the basis of sensitivity. **7**

b) The stresses on a failure plane in a drained test on a cohesionless soil are as under normal stress (σ) is 95 kN/m^2 & shear stress (τ) 45 kN/m^2. **7**

i) Determine the angle of shearing resistance & angle which the failure plane make with the major principal plane.

ii) Find the major & minor principal stress.

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B.E. Fourth Semester (Civil Engineering) (C.B.S.)

Geotechnical Engineering - I Paper – II

P. Pages : 3 **KNT/KW/16/7264**

Time : Three Hours * 0 1 3 4 * Max. Marks : 80

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8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.

1. a) Discuss about formation of soil. **6**

b) Derive: **7**

$$\gamma_d = \frac{(1-n_a)\, G\, \gamma_\omega}{1+\omega G}$$

OR

2. a) Differentiate between Residual soil & transported soil. **6**

b) During a test for water content determination on a soil sample by pycnometer, the following observations were recorded. **7**

i) Mass of wet soil sample with = 1000 gm pycnometer.

ii) Mass of pycnometer with soil = 2000 gm and filled with water.

iii) Mass of pycnometer filled with = 1480 gm water only.

iv) Specific gravity of solids = 2.67

Determine the water content.
If the bulk density of the soil is 2.05 gm/ml, Determine the degree of saturation.

3. a) Explain the term density Index. What is it's utility? For what type of soil is useful. **6**

b) The oven-dry mass of pat of clay is 10.8 g and the mass of mercury displaced on immersion is 84.2 g. Taking the specific gravity of solids as 2.72, determine the shrinkage limit and Shrinkage ratio. **7**

OR

4. a) Explain various methods to find water content of a soil. **6**

b) A test was carried out for determination of liquid limit of soil sample. The following sets of observations were taken. Determine liquid limit and flow Index. **7**

No. of Blows (N)	38	27	20	13
Water content (%)	47.5	49.5	52	54

5. a) Write a brief note on "Quick Sand" condition. **6**

b) A falling head permeability test was carried on 15 cm long clay sample. The diameter of sample and stand pipe was 9.8 cm and 0.75 cm respectively. The level of water in stand pipe dropped from 60 cm to 45 cm in 12 minutes. **8**
Determine:
i) Permeability in m/day
ii) Time required for level to drop to 10 cm.

OR

6. a) Explain four important factors affecting the permeability of soil. **6**

b) Find the ratio of average permeability in the horizontal to that in vertical direction for a soil deposite of three layers with thickness in the ratio 1:2:3. The permeability of the second layer is twice that of first and third is twice that of the second. **8**

7. a) Explain Equivalent point load method in brief. **6**

b) Two columns 3m apart transfer loads of 300 kN and 400 kN on a semi-infinite soil surfaces. Plot the combined effect of both the loads of normal stress on a horizontal plane 3m below the plane of loading. **7**

OR

8. a) Explain the construction and use of Newmark's influence chart. **6**

b) Discuss assumptions made in Boussinesq's equation, **3**

c) Explain the terms. **4**
i) Isobars.
ii) Vertical pressure on vertical plane.

9. a) Explain: **6**
i) Coefficient of compressibility.
ii) Coefficient of volume change.
iii) Compression Index.

b) Explain different factors affecting compaction of soil. **7**

OR

10. a) Explain Terzaghi's one dimentional consolidation from along with assumptions. **6**

b) Following data is for a standard compaction test on soil using a mould of volume 1000 cm^3. **7**

Water content (%)	8.5	12.5	13.75	15.5	18.2	20.2
Wt. of compacted sample (N)	18	19.4	20	20.5	20.3	19.3

11. a) Explain Mohr - Coulomb theory for shear strength of soil. **7**

b) A specimen of clean dry sand failed at a shear stress of 0.35 kg/cm^2 and normal stress of 0.5 kg/cm^2 . If an identical specimen is tested in triaxial cell with a lateral pressure of 0.5 kg/cm^2 , find the axial stress at failure. **7**

OR

12. a) Show that the angle of inclination of failure plane is $(45 + \phi/2)$ **6**

b) The stresses on a failure plane in a drained test on a cohesionless soil are as under. Normal stress (σ) is 95 kN/m^2 and shear stress (τ) is 45 kN/m^2. **8**

i) Determine the angle of shearing resistance and angle which the failure plane make with the major principal plane.

ii) Find the major and minor principal stress.

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B.E. (Civil Engineering) Fourth Semester (C.B.S.)

Geotechnical Engineering - I

Paper – II

P. Pages : 3 **TKN/KS/16/7352**

Time : Three Hours * 0 4 7 2 * Max. Marks : 80

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9. Assume suitable data whenever necessary.
10. Diagrams and chemical equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.

1. a) Write a brief note on "Soil Formation". **6**

b) A relative density test conducted on a sandy soil yielded the following results. Maximum void ratio = 1.20, Minimum void ratio = 0.40, relative density 40%, G = 2.67. Find dry density of the soil in the present state. If 3m thick of this stratum is densified to relative density of 60%. How much it will reduce in thickness? What will be new density in dry & saturated condition. **7**

OR

2. a) Derive from the first principles, W. G. = e. Sr. **6**

b) A clay sample is found to weight 445.54 gms in its natural state. It is then dried in an electric oven at 105ºC. The dried weight is found to be 327.56 gm. The specific gravity of the solids is 2.7 & unit weight of the soil mass in its natural state is 1.7 gm/cc. Determine the water content, degree of saturation & the dry unit weight of the mass in its natural state. **7**

3. a) Define Consistency Index & explain it. **6**

b) A test for determination for liquid limit was carried out on a soil sample. The following tests of observations were taken. Determine liquid limit & flow index. **7**

No. of Blows (N)	Water content %
38	47.3
27	49.6
20	53
13	55

OR

4. a) Write a note on Textural classification of soils. **6**

b) Determine flow index, liquidity index & consistency index, if L.L. = 67%, P.L. = 33%. natural water content = 43% & given that at water content of 30%, the no. of blows in liquid limit test were 48. **7**

5. a) What are the factors affecting permeability of soil? **7**

b) A falling head permeability test was carried on 15 cm long clay sample. The diameter of sample & stand pipe was 10 cm & 0.75 cm respectively. The level of water in stand pipe dropped from 60 cm to 45 cm in 15 minute. **7**
Determine :
1. Permeability in m/day.
2. Time required for level drop to 10 cm.

OR

6. a) Write a short note on properties of flow net. **6**

b) What are remedial measures to reduce seepage pressure in hydraulic structure. **4**

c) Define the terms : **4**

i) Hydraulic Head.

ii) Hydraulic Gradient.

7. a) Discuss assumptions and limitations of Boussinesq approach as applied for determination of stresses induced in a soil mass due to surface loading. **6**

b) A point load of 5 tonnes acts on the surface of ground. Calculate the vertical pressure due to this load at depths of 5.00 & 6.00 m at 3.00 m Horizontally away from the axis of loading in both the cases. **7**

OR

8. a) Explain the terms Isobars, Pressure bulb. **6**

b) A rectangular area $1.5\,m \times 3.0\,m$ carries a uniformly distributed load of $50\,KN/m^2$ at the ground surface. Find the vertical pressure at 4.0 m below the centre and corner of the loaded area by equivalent point load method. **7**

9. a) State the equation for final consolidation settlement & explain the terms in this equation. **6**

b) In a laboratory consolidation test a 25 mm thick sample takes 60 minutes to reach 50% consolidation. How much time will a 4.5 m thick layer of clay in the field required to attain (i) 50%, (ii) 90% consolidation if it can drain both at top & bottom. **7**

OR

10. a) State the factors affecting compaction. **6**

b) Following data is for a standard compaction test on soil using a mould of volume 1000 cm^3. **7**

Water content (%)	Wt. of compacted sample (N)
8.5	18.5
12.5	20
13.75	20.5
15.5	20.8
18.2	20.4
20.2	19.8

Determine optimum moisture content and maximum dry density values.

11. a) Using a Mohr's diagram derive a relationship between major & minor principal stress in terms of shear parameters. **7**

b) If the major & minor principal stresses on a specimen of soil at the instant of failure are $500\,KN/m^2$ & $150\,KN/m^2$ respectively. **7**
Calculate the values of normal & shear stress on a plane inclined at an angle of 65º with major principal plane.

OR

12. a) Explain what is meant by sensitivity of soil. How soil are classified on the basis of sensitivity. **7**

b) The stresses on a failure plane in a drained test on a cohesionless soil are as under – Normal stress (σ) is $95\,KN/m^2$ & shear stress is (τ) $45\,KN/m^2$. **7**

i) Determine the angle of shearing resistance & angle which the failure plane make with the major principal plane.

ii) Find the major & minor principal stress.

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