SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code : Geotechnical Engineering **(**16CE122) **Course & Branch**: B.Tech - CE

Year & Sem: III-B.Tech & I-Sem **Regulation:** R16

UNIT –I

1. a) Explain the phenomenon of formation and transportation of soils. 5M
   b) Write notes on structure of soils. 5M

2. a) Explain with sketches various types of soil structures. 5M
   b) Explain Clay mineralogy. 5M

3. a) Using three phase diagram of soil, derive an expression for water content in terms of void ratio, Specific gravity and degree of saturation. 5M

   b) A saturated soil sample has a water content of 25% and unit weight of 20 KN/m^3. Determine the Specific gravity of the solid particles, dry unit weight and void ratio. 5M

4. Using three phase diagram of soil, derive an expression for saturated unit weight of soil in terms of Void ratio, unit weight of water, specific gravity and degree of saturation. 10M

5. A sample of clay soil of volume 1×10^{-3} m^3 and weight 17.62 N, after being dried out in an oven had A weight of 13.68 N. If the specific gravity of the particle was 2.69 find void ratio, saturated unit Weight, dry unit weight and water content. 10M

6. a) The unit weight of sand backfill was determined by field measurements to be 17.13kN/m^3. The Water content at the time of test was 8.60% and the unit weight of the solid constituents was 25.50kN/m^3.In the laboratory the void ratio in the loosest and densest state ware found to be 0.642, 0.462 5M
   b) What was the relative density write the importance of this term? 5M

7. a) Explain Relative density. 5M
   b) How to determine field density by using sand replacement method 5M

8. a) Briefly explain the Procedure of core cutter method 5M
   b) Explain Determination of specific gravity in the laboratory 5M

9. Describe in detail the Indian System of soil classification. When would you use dual symbols For Soils? 10M

10. Define the following:
   (*i*) Flow index, 2M
   (*ii*) Toughness index, 2M
   (iii) Liquidity index, 2M

(*iv*) Shrinkage index, 2M
(v) Plasticity index, 2M

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UNIT –I

1. Soils are basically [ ]

A) Organic Materials B) Inorganic Materials C) A&B D) None

2. The behavior of clay is governed by [ ]

A) Mass energy B) Surface energy C) Friction D) None

3. Lacustrine soil is a_____ [ ]

A) Soil Deposited in Sea B) Wind – borne Soil

C) Soil deposited In Lake D) Soil formed by vegetation matter

4. Chemical weathering occurs because Of [ ]

A) Oxidation B) Carbonation C) Hydration D) All The Above

5. The term soil Mechanics was coined by [ ]

A) Terzaghi B) Cassagrande C) Newmark D) Rankine

6. Talus is the soil transported by [ ]

A) Gravitational B) Water C) Glacier D) Wind

7. Varved clay is _____ [ ]

A) A Mixture of sand, silt, clay B) A Chemically bonded soil mixture

C) Alternate thin layers of silt and clay D) Decomposed volcanic ash deposit

8. Aeolian soils are _____ [ ]

A) Residual soils B) Wind deposits C) Gravity deposits D) Water deposits

9. Loam means [ ]

A) Sandy clay with a little slit B) Silty clay with a little sand

C) Sand, silt and clay D) Sand, slit and gravel

10. Human is [ ]

A) A half decomposed soil B) Fully decompose soil

C) Inorganic soil D) A type of rock

11. Pycnometer method is used to determine [ ]

A) Water content and void ratio B) Specific gravity

C) Specific gravity and dry density D) Specific gravity and water content.

12. If the moisture content of a fully saturated soil is 100%, then the void ratio is equal to [ ]

A) Mass specific gravity B) True specific gravity.

C) Half of true specific gravity D) No relation with specific gravity.

13. The soil that will have generally maximum void ratio is [ ]

A) Gravel B) Sand C) Silt D) Clay

14. For a given soli the following unit weight is constant [ ]

A) Bulk unit weight B) Dry unit weight

C) Saturated unit weight D) Unit weight of solids

15. For a stable packing of regular spheres at the minimum density, the void ratio is [ ]

A) 0.91 B) 0.81 C) 0.65 D) 0.34

16. The void ratio in soils is defined as the ratio of volume of [ ]

A) Void to solids volume B) Voids to soil volume

C) Solid to voids volume D) Solids to total volume

17. Theoretically, the void ratio in soils can have the following values. [ ]

A) Less than one only B) More than one

C) Can be less or more than one D) Less than 0.5

18. For a dense packing regular sphere at the maximum density, the void ratio is [ ]

A) 0.91 B) 0.81 C) 0.65 D) 0.35

19. When porosity is 50%, the void ratio is [ ]

A) 0 B) 0.50 C) 1 D) 1.5

20. The standard method of determining water content is [ ]

A) Oven – drying method B) Alcohol method

C) Calcium carbide method D) Pycnometer method

21. The ranges of Void ratio ‘e’ are [ ]

A) e >0 B) e<0 C) e>1 D) 0<e<1

22. If the void ratio is 0.5, then the porosity is [ ]

A) 0.333 B) 1 C) 0.666 D) 0.5

23 .In a soil mass if volume of voids Is equal to volume of solids, then values of voids ratio and porosity are respectively- - - [ ]

A) 0.5 B) 1, 0.5 C) 1.5, 0.5 D) 0.5, 1.5

24. In case of silts the following type of soil structure is exhibited [ ]

A) Single grained B) Honey-combed C) Flocculated D) Dispersed

25. The shape of the clay particle is [ ]

A) Rounded B) Angular C) Flaky D) Any of a, b, c

26. Sand particles made up of [ ]

A) Rock minerals B) Kaolinite C) Illite D) All the above

27. Among the given soils, the specific surface area is highest for [ ]

A) Gravel B) Sand C) Silt D) Clay

28. The soil sample used for Liquid limit, Plastic limit and Shrinkage limit tests should be [ ]

A) 75 microns B) 150 microns C) 200 microns D) 425 microns

29. A clay is said to be fat when its liquid limit is [ ]

A) 10 to 20% B) 20 to 30% C) 30to 50% D) more than 50%

30. The most uniformly graded soil is [ ]

A) Dune sand B) Loess C) Talus D) Loam

31. In hydrometer analysis the principle used is [ ]

A) Newton's law B) Darcy's law C) Stoke's law D) Rehabann's law

32. The effective size of the soil is [ ]

A) D_{15} B) D_{85} C) D_{10} D) D_{90}

33. Soil which contains the particles of different sizes in good proportion is called [ ]

A) Uniform soil B) Well graded soil C) Consistent soil D) None of the above

34. The shrinkage limit the degree of saturation is [ ]

A) Liquid limit- plastic limit B) Liquid limit- shrinkage limit

C) Plastic limit – liquid limit D) Plastic limit-shrinkage limit

35. The biggest size of clay size particle is [ ]

A) 0.0002mm B) 0.002mm C) 0.02mm D) 0.075mm

36. The symbol 'SM' indicates [ ]

A) Sandy silt B) Medium sand C) Silty sand D) Medium

37. Silty clay indicates [ ]

A) Silt percentage is greater than that of clay B) Clay percentage is greater than that of silt

C) Both silt and clay have equal proportion D) None

38. Amongst the following, the smallest particle size is [ ]

A) Silt B) Clay C) Sand D) Colloidal

39. The maximum size of fine grained soils is [ ]

A) 0.002mm B) 0.075mm C) 0.75mm D) 4.75m

40. A soil has the liquid limit of 30. The corresponding plasticity index given by the A-line is [ ]

A) 7.3 B) 7.5 C) 9.0 D) 9.5

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UNIT –II

1. a) Explain the phenomenon of capillary rise in soil and write an expression for the Capillary rise. 5M
   b) Write an expression for determining permeability of soil by falling head permeameter and Explain the terms 5M
2. A falling head permeability test is to be performed on a soil sample whose permeability is estimated To be about 3×10^{-5} cm/sec. What diameter of the stand pipe should be used if the head is to drop From 27.5 cm to 20.0 cm in 5 minutes and if the cross-section area and length of the sample are Respectively 15 cm^2 and 8.5 cm. How much time will it take for the head to drop from37.5 cm to 30.0 cm. 10M

3. Define permeability & Darcy's law. How do you determine the permeability of a clayey soil in the Laboratory? Write the formula you use and explain the terms 10M

4. Write the permeability equation by constant head method and explain factors effecting permeability.

5. Briefly explain determination of permeability by stratified soil system 10M

6. a) Explain factors effecting permeability 5M

   b) Estimate the quantity of flow of water through a soil mass in a 300 sec period when a constant Head of 1m is maintained. The length of the sample is 150 mm and the cross sectional area is 100×100 mm. The coefficient of permeability of the soil sample is 1×10^{-1} mm/s. 5M

7. What is flow net? Describe its properties and applications. How to construct a flow net? 10M

8. Explain in details about Quick sand condition. 10M

9. A 1.25 m layer of the soil (G = 2.65 and porosity = 35%) is subject to an upward seepage head of 1.85 m. What depth of coarse sand would be required above the soil to provide a factor of safety of 2.0 Against piping assuming that the coarse sand has the same porosity and specific gravity as the Soil and that there is negligible head loss in the sand. 10M

10. An earth dam is built on an impervious foundation with a horizontal filter at the base near the toe. The permeability of the soil in the horizontal and vertical directions are 3×10^{-2} mm/s and 1×10^{-2} mm/s respectively. The full reservoir level is 30 m above the filter. A flow net constructed For the transformed section of the dam, consists of 4 flow channels and 16 head drops. Estimate the Seepage loss per meter length of the dam. 10M

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UNIT –II

1. The property of soil which allows water to flow through the soil is known as [ ]

A) Capillarity B) Permeability C) Fluidity D) Viscosity

2. Darcy's law is applicable if a soil is [ ]

A) Homogeneous B) Incompressible C) Isotropic D) All the Above.

3. According to Darcy's law, the flow velocity can be obtained by [ ]

A) $\frac{KI}{A}$ B) KIA C) KI D) $\frac{K}{A}$

4. Capillary force is dependent on [ ]

A) Pore pressure B) Water content C) Depth to water table D) Surface tension of water

5. Velocity heads in soils will be [ ]

A) Very High B) High C) Negligible D) Can't say.

6. The pore water pressure in the capillary zone is [ ]

A) Positive B) Negative C) Zero D) Can't say

7. A soil which does not permit the passage or seepage of any permeate though its voids, is known as [ ]

A) Solid soil B) Hard soil C) Impermeable soil D) Honey comb soil.

8. In most of the practical flow problems in soil mechanics, the flow is [ ]

A) Laminar B) Turbulent C) Supersonic D) Subsonic

9. The value of Reynolds's number for laminar flow through soil is [ ]

A) Less than 20,000 B) Less than 2,000 C) Less than 200 D) Less than 20

10. Magnitude of capillary rise is more in [ ]

A) Silts B) Sands C) Clays D) Gravels.

11. Piping in soils is due to [ ]

A) Low exit gradient

B) Erosion of subsoil by high velocity of seepage flow

C) Leakage of water through pipes laid in dams

D) Passage of water through well-connected pores in soil

12. Physical properties of a permeate which influences the permeability are [ ]

A) Viscosity only B) Unit weight only C) Both viscosity and unit weight D) None

13. Units of co-efficient of permeability [ ]

A) cm/s B) s/cm C) cm/s^2 D) s^2/cm

14. Which of the following soils has largest permeability? [ ]

A) Sand B) Gravel C) Silt D) Clay

15. Falling head permeameter is preferable when soil sample is [ ]

A) Clayey B) Silty sandy C) Sandy D) Sandy gravel.

16. In the case of stratified soils, the permeability's Kx and Kz along across stratification are related as

A) Kx <Kz B) Kx >Kz C) Kx = Kz D)None

17. The range coefficient of permeability of sands is about [ ]

A) $<10^{-6}$ B) 10^{-4} to 10^{-6} C) 10^{-2} to 10^{-4} D) 10^{-2} to 1

18. The value of coefficient of permeability of clays is [ ]

A) $<10^{-6}$ B) 10^{-4} to 10^{-6} C) 10^{-2} to 10^{-4} D) 10^{-2} to 1

19. Soil with a value for coefficient of permeability ranging between 10^{-4} to 10^{-6} are classified as [ ]

A) Pervious soils B) Semi-pervious soil C) Impervious soils D) All the above

20. The expression for critical gradient is [ ]

A) $i_c=\frac{G-1}{1+e}$ B) $i_c=\frac{G+1}{1+e}$ C) $i_c=\frac{G-1}{1-e}$ D) None

21. The presence of entrapped air in a soil will [ ]

A) Increase the permeability B) Decrease the permeability

C) No effect on permeability D) Can't say

22. The presence of organic matter in a soil will [ ]

A) Increase the permeability B) Decrease the permeability

C) No effect on permeability D) Difficult to guess

23.The phenomenon is in up which a cohesion less soil loses all its shear strength and the soil particles have a tendency to move up in the direction of flow, is known as [ ]

A) Boiling condition B) Quick sand C) Quick condition D) All the a above

24. Flow net consists of a number of stream line and equipotential line which are [ ]

A) Parallel to each other B) Perpendicular to the equipotential lines

C) Orthogonal to each other D) None of the above

25. Flow net is used for the determination of [ ]

A) Exit gradient B) Seepage C) Hydrostatic pressure D) All the above

26. The flow net can be obtained by [ ]

A) Electrical analogy method B) Graphical method C) Solution of laplace equations D) All the above

27. The shape factor of a flow net is defined as [ ]

A) $\frac{Nd}{Nf}$ B) $\frac{Nf}{Nd}$ C) Both D) None

28. The phreatic line is [ ]

A) The u/s face of the earth dam B) D/S face of the earth dam

C) The top flow line D) None of the above

29. For large engineering projects the permeability is determined by using [ ]

A) Constant head B) Falling head C) Pumping in D) Pumping out

30. In a coarse grained soil having e=0.75, G=2.75, the critical hydraulic gradient is [ ]

A) 0.25 B) 0.5 C) 1.0 D) 0.75

31. Magnitude of capillary rise more in [ ]

A) Silts B) Sands C) Clays D) Gravel

32. The seepage (q) through earth dam can be calculated by using [ ]

A) $kh(\frac{Nd}{Nf})$ B)$kh\sqrt{(\frac{Nf}{Nd})}$ C) $kh(NdxNf)$ D) $kh(\frac{Nf}{Nd})$

33. When the water level in a lake (or tank) rises, the effective stresses in the soil below are [ ]

A) Increased B) Decreased C) Unchanged D) None of the above

34. In a saturated soil deposit having a density of 25kn/m^3,the effective normal stress on a horizontal plane at 4m depth will be---kn/m^3 [ ]

A) 20 B) 40 C) 60 D) 80

35. .Capillary force is dependent on [ ]

A) Pore pressure B) Water content C) Depth of water D) Surface tension

36.For a given soil mass the average permeability is 10^{-3}cm/sec and coefficient of permeability in horizontal direction is $5x10^{-3}$cm/sec,then permeability in vertical direction is—cm/sec [ ]

A) $2x10^{-4}$ B) $5x10^{-4}$ C) $4x10^{-3}$ D) 6x10

37. Which of the following is an effective pressure [ ]

A) Pore water pressure B) Capillary pressure C) Water load D) None of the above

38. Space between two adjacent flow lines is called [ ]

A) Flow potential B) Flow path C) Flow field D) Flow length

39. Piping occurs when [ ]

A) Effective stress 0 B) Flow is down word C) Flow is up word D) Flow is horizontal

40. Coefficient of permeability of soil varies approximately as [ ]

A) $D_{10}{}^2$ B) $\sqrt{D}10$ C) $D_{30}{}^3$ D) All of these

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UNIT –III

1. Derive an expression for the vertical stress at a point due to a point load, using Boussinesq's theory. 10M

2. Explain Westergaard's theory for the determination of the vertical stress at a point. 10M

3. A concentrated load of 1500 kN acts vertically at the ground surface. Determine the vertical stress at A point which is at 10M
   i) a depth of 2.5 m and a horizontal distance of 4.0 m.
   ii) at a depth of 5.0 and a radial distance of 2.5 m.
4. A rectangular area 4 m × 6 m carries a uniformly distributed load of 100 kN/m^2 at the ground Surface. Estimate the vertical pressure at a depth of 6 m vertically below the centre 10M

5. (*a*) Explain the concept of 'Pressure Bulb' in soils. 5M
   (b)What do you understand by 'Pressure bulb'? Illustrate with sketches 5M

6. Describe the Standard Proctor test and modified Proctor test to be conducted in the laboratory. 10M

7. What are the factors that affect compaction? Discuss in brief. 10M

8. Write short notes on
   (*i*) Field compaction control 5M
   (*ii*) Method of compaction 5M

9. The following data are obtained in a compaction test.
   Specific gravity = 2.65

Moisture content (%)	2	4	5.8	6.7	7.8	10
Wet density (kN/m^3)	20.4	20.9	21.4	22.2	22.4	22.0

   Determine the OMC and maximum dry density. Draw 'Zero-air-void line' 10M

10. The soil from a borrow pit is at a bulk density of 17.50 kN/m3 and a water content of 12.3%. It is Desired to construct an embankment with a compacted unit weight of 19.82 kN/m3 at a water Content of 17%.Determine the quantity of soil to be excavated from the barrow pit and the amount of water to be added for every 100 m3 of compacted soil in the embankment. 10M

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UNIT –III

1. The total load acting on the soil mass per unit area is called [ ]

A) Total stress B) Neutral stress C) Effective stress D) None

2. The stress induced in the pore water is termed as [ ]

A) Total stress B) Neutral stress C) Effective stress D) None

3. For calculating the stress distribution in soil, Boussinesq assumed the point load to exist [ ]

A) Below the ground level B) Below water table C) At the ground level D) At water table

4. Geostatic stresses are due to [ ]

A) Static loads B) Dynamic load C) Self weight of soil D) None of above

5. The value of vertical stress [ ]

A) Decreases with an increase in (r/f) ratio B) Decreases with a decrease in r/f ratio

C) Increase with an increase in (r/f) ratio D) Difficult to guess

6. Vertical stress on a vertical plane which is at particular radial distance from the axis of a vertical Concentrated load is [ ]

A) At all depth

B) Decreases with depth constantly

C) Increases first, attains a maximum value and then decreases

D) Decrease first, attains a maximum and the increases

7. The expression for vertical stress at point below the corner of a rectangular loaded area Was derived by [ ]

A) Boussinesq B) Westergaard's C) Newmark D) Fenske

8. Select the incorrect statement [ ]

A) The stresses increases with depth because of over burden pressure

B) The stresses decreases with depth because of the applied load

C) The stresses decreases with depth in case of bath over burden and applied loads

D) None of the above

9. The specialty of the Newmark's diagram is that it can be used for finding the stress below [ ]

A) Rectangular loaded areas, at any point

B) Circular loaded area, the centre

C) Rectangular loaded area, below the corner

D) Any shape of loaded area at any point

10. Westergaard's theory is more appropriate for [ ]

A) Layered soils B) Homogeneous deposits

C) Anisotropic soils D) Normally consolidated homogeneous soils

11. When compared with Boussinesq coefficient values, the values of Westergaard's coefficient Will be [ ]

A) Higher B) Smaller C) Same D) Can't say

12. The vertical stress at any point can be calculated approximated by [ ]

A) Equivalent point load method B) 2:1 Distribution method

C) Sixty degrees distribution D) All the above

13. The upward pressure due to soil on the underside of a footing is generally called as [ ]

A) Vertical stress B) Tangential stress C) Contact pressure D) None of the above

14. The maximum contact pressure for a rigid footing on cohesion less soil will be at [ ]

A) Edges B) Center C) Between centre and edge D) none

15. The expression for the vertical stress at a point p using Newmark's chart is [ ]

A) σ_Z=I n q B) $\sigma_z=\frac{I\,n}{q}$ C) $\sigma_z=\frac{q}{I\,n}$ D)None

16. The westergaad analysis is used for [ ]

A) Homogeneous soils B) Cohesive soils C) Sandy soils D) Stratified soils

17. The stress developed at a point in the soil exactly a point load at the surface is [ ]

A) Proportional to the depth of point B) Proportional to square of the depth of point

C) Inversely Proportional to the depth of point D) Inversely Proportional to square of the depth of point

18. The effect of pore water pressure is _____ to the volume of soil [ ]

A) Increases B) Decreases C) Constant D) None

19. The effective stress is effective in_____the void ratio of soil mass [ ]

A) Increases B) Decreases C) Constant D) None

20. The curve joining the points of equal stress intensity is called [ ]

A) Isobar B) Isochrones C) Isotropic D) None

21. The admixture used in soil stabilization is [ ]

A) Cement B) lime C) Bitumen D) Any of the above

22. In the modified proctor test the drop height of the rammer [ ]

A) 30cm B) 45cm C) 60cm D) 75cm

23. Factors affecting the compaction is/are [ ]

A) Water content B) Compactive energy C) Soil type D) All the above

24. The following soil has highest O.M.C [ ]

A) Gravel B) Sand C) Silt D) Clay

25. Optimum moisture content is the moisture content exhibit [ ]

A) Settlement is maximum B) Permeability is more

C) Dry density is maximum D) Shear strength is less

26. Clay particles on the wet side of optimum moisture content exhibit [ ]

A) Single grained structure B) Disperse structure

C) Honeycomb structure D) Flocculent structure

27. Compaction of a soil is measured in terms of [ ]

A) Dry density B) Specific gravity C) Compressibility D) Permeability

28. Vibrator roller is useful for compacting [ ]

A) Clayey soil B) Cohesion less soil C) Gravel D) Crushed rock

29. Relative compaction is [ ]

A) Similar to relative density B) A compaction process

C) A ratio of γ_d field to the γ_d of lab D) Dry density obtained in the field

30. For pure sandy soil [ ]

A) Compaction curve is not useful

B) A well defined OMC exists

C) Modified proctor test is recommended

D) Jodhpur miniature compaction test recommended

31. To avoid large swelling pressure under pavements and floors, the soil is compacted [ ]

A) At OMC B) Dry of optimum C) Wet of optimum D) None

32. Clayey soils are best compacted by [ ]

A) Vibration B) Kneading C) Impact D) All the above

33. The number of blows required for compacting each layer of soil in compacting test is [ ]

A) 25 B) 36 C) 56 D) 45

34. The process of compaction of soil involves [ ]

A) Expulsion of pore eater B) Expulsion of air C) Both A&B D) None

35. For the same soil, increase in compaction effort [ ]

A) Does not affect OMC B) Increase OMC C) Decreases OMC D) Decreases density

36. the most effective method for compacting sand is by using [ ]

A) Pneumatic rollers B) Sheep foot rollers C) Steel typed rollers D) Vibration

37. In modified proctor test the drop of height of rammer is [ ]

A) 30 cm B) 45 cm C) 60 cm D) 75 cm

38. Compaction of soil [ ]

A) Increases dry density B) Decreases porosity C) Both a& b D) None

39. Compaction process may be accompanied by [ ]

A) Rolling B) Tamping C) Vibration D) Any of the above

40. The ratio of dry density obtained in the field to the proctor's maximum dry density is called [ ]

A) Compaction energy B) Compaction effort C) Relative compaction D) None

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UNIT –VI

1. Define the Following terms
   i) Coefficient of compressibility, 2M
   ii) Coefficient of volume change 2M
   iii) Compression index, 2M
   iv) Expansion index, 2M
   v) Recompression index. 2M

2. Describe the consolidometer test. Show how the results of this test are used to predict the rate of Settlement and the magnitude of settlement 10M

3. Obtain the differential equation defining the one-dimensional consolidation as given by Terzaghi, Listing the various assumptions 10M

4. Discuss the spring analogy for primary consolidation. What are it uses 10M

5. In a consolidation test the following results have been obtained. When the load was changed from 50 kN/m^2 to 100 kN/m^2, the void ratio changed from 0.70 to 0.65. Determine the coefficient of volume Decrease, m_v and the compression index, C_c 10M

6. A sand fill compacted to a bulk density of 18.32 kN/m^3 is to be placed on a compressible saturated Mass deposit 4 m thick. The height of the sand fill is to be 3.5 m. If the volume compressibility m_v Of the deposit is 6.5×10^{-4} m^2/kN, estimate the final settlement of the fill. 10M

7. A layer of soft clay is 5 m thick and lies under a newly constructed building. The weight of sand Overlying the clayey layer produces a pressure of 250 kN/m^2 and the new construction increases the Pressure by 120 kN/m^2. If the compression index is 0.5, compute the settlement. Water content is 40% and specific gravity of grains is 2.68. 10M

8. The settlement analysis (based on the assumption of the clay layer draining from top and bottom Surfaces) for a proposed structure shows 3 cm of settlement in four years and an ultimate Settlement of 10 cm. However, detailed sub-surface investigation reveals that there will be no Drainage at the bottom. For this situation, determine the ultimate settlement and the time required For 2.5 cm settlement. 10M

9. The void ratio of clay **A** decreased from 0.574 to 0.512 under a change in pressure from 125to 185 kg/m^2. The void ratio of clay **B** decreased from 0.608 to 0.592 under the same increment of Pressure. The thickness of sample **A** was 1.5 times that of **B**.Then time required for 50% Consolidation was three times longer for sample **B** than for sample **A**. What is the ratio of th Coefficient of permeability of **A** to that of **B** 10M

10. A saturated soil has a compression index of 0.25. Its void ratio at a stress of 10 kN/m^2 is 2.06 and Its permeability is 3.7×10^{-7} mm/s. Compute
(*i*) Change in void ratio if the stress is increased to 18.5 kN/m^2; 4M
(*ii*) Settlement in (*i*) if the soil stratum is 5 m thick; and 3M
(*iii*) Time required for 40% consolidation if drainage is one-way. 3M

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QUESTION BANK (OBJECTIVE)

Subject with Code : Geotechnical Engineering **(**16CE122) **Course & Branch**: B.Tech - CE

Year & Sem: III-B.Tech & I-Sem **Regulation:** R16

UNIT –IV

1. Consolidation of soil is a load which is [ ]

A) Static and short term B) Dynamic and short term

C) Dynamic and log term D) Static and log term

2. Time is an important parameter in the consolidation of [ ]

A) Sands only B) Clay only C) Both sands and clays D) None

3. 'Primary compression' is mainly due to expulsion of [ ]

A) Air B) Water C) Both air and water D) None

4. 'Secondary consolidation' is mainly due to expulsion of [ ]

A) Highly Viscous water B) Plastic readjustment of solid particles

C) Both (A) and (B) D) None of the above

5. If a soil has ever been subjected to a pressure in excess of its present over burden, the soil is Said to be [ ]

A) Pre-consolidated B) Normally consolidated

C) Under consolidated D) None of the above

6. Coefficient of consolidated depends upon [ ]

A) Permeability B) Coefficient of volume change

C) Unit weight of water D) All the above

7. The unit of coefficient of consolidation is [ ]

A) $\frac{cm}{sec}$ B) $\frac{cm2}{sec}$ C) $\frac{cm}{sec2}$ D) No units

8. The ratio of settlement at any time't' to the final settlement is known as [ ]

A) Coefficient of consolidation B) Degree of consolidation

C) Time factor D) Consolidation of undisturbed soil

9. 'Isochrones' are the curves showing distribution of [ ]

A) Total settlement B) Total pressure C) Excess hydrostatic pressure D) None

10. The slope of is any point at a given time indicates the rate of change of [ ]

A) Effective stress with depth B) Effective stress with time

C) Pore water pressure with time D) Pore water pressure with depth

11. Time factor is [ ]

A) A non dimensional parameter B) A function of degree of consolidation

C) Directly proportional permeability of soil D) All the above are correct

12 .In the soil sample of a consoled meter test, pore water pressure is [ ]

A) Minimum at the center B) Maximum at the top

C) Maximum at the bottom D) Maximum at the centers

13. Which of the following soils will generally have maximum compressibility, [ ]

A) Gravels B) Sands C) Slits D) Clays

14. The ultimate consolidation settlement of a soil is [ ]

A) Directly proportional to the compression index

B) Decrease with the increase in the initial voids ratio

C) Both (A) & (B)

D) None

15. A saturated clay layer with single drainage face take 4 years to attain 50% layer had double Drainage, then the time required to attain 50% [ ]

A) 8 B) 4 C) 2 D) 1

16. In consolidation testing, curve fitting method is used to determine [ ]

A) Compression index B) Swelling index

C) Coefficient of consolidation D) Time factor

17. Secondary consolidation is [ ]

A) Caused by hydrodynamic lag

B) Caused by creep

C) Large for the pressures below the pre- consolidation pressure

D) Very small for highly plastic clays and organic clays.

18. The recompression index is about ------- of the compression index [ ]

A) 5 times B) $\frac{1}{5}$ C) $\frac{1}{2}$ D) $\frac{1}{20}$

19. Consolidation time of a soil sample [ ]

A) Increases with an increase permeability B) Increases with a decreases in compressibility

C) Increases with decrease in unit weight of water D) Increases with a decrease in permeability

20. The ultimate settlement of a soil deposit increases with [ ]

A) An increases in the compression index B) An increases in the initial void

C) A deceases in thickness of the stratum D) An increase in time

21. Consolidation theory was enunciated by [ ]

A) Rankine B) Westergaard C) Skempton D) Terzaghi

22. Consolidation is generally is generally considered to be a function of [ ]

A) Total stress B) Neutral stress C) Effective stress D) None

23. Consolidation is a process involving [ ]

A) Sudden compression of soil B) Tilting and failure of structure

C) Abnormal sinking of foundation D) Gradual expulsion of pore water

24 .When a static load is applied, the consolidation is fast in the case of [ ]`

A) Clays B) Silty clays C) Sandy silts D) Sands

25. The coefficient of consolidation of a soil is affected by [ ]

A) Compressibility only B) Permeability only

C) Both compressibility and permeability D) None

26. The expression for organic soil and peats is [ ]

A) $C_C = 0.009(LL-10\%)$ B) $C_C = 0.009(10\%- LL)$

C) $C_C = 0.1(LL-20\%)$ D) $C_C = 0.1(20\%-LL)$

27. The maximum over consolidation ratio of normally consolidated soil is [ ]

A) One B) Two C) Three D) Four

28. Compressibility of a clayey soil will be [ ]

A) Equal to that of sandy soils

B) Greater than sandy soils

C) Greater than that of a normally consolidated clay

D) Less than that of normally consolidated clay

29 .As the value of drainage path increases the time for consolidation will [ ]

A) Decrease B) Increase C) Constant D) can't say

30. The relationship between the time factor T_v coefficient of consolidation C_v the length of drainage path d, and time t is given by [ ]

A) $T_V = (C_V D^2)/t$ B) $T_V = (2CVD2)/t$ C) $T_V = (3 C_V D^2)/t$ D) $T_V = (C_V D^2)/4t$

31. The time factor for a particular degree of consolidation [ ]

A) Depends upon the coefficient of consolidation

B) Depends upon the drainage path

C) Depends upon the distribution of initial excess hydrostatic pressure

D) None of the above

32. The compression of soils occurs rapidly if voids are occupied by [ ]

A) Air B) Water C) Partly air& water D) None of the above

33. The compression resulting from long term static load and resulting expulsion of water is known as [ ]

A) Compaction B) Inverse swelling C) Consolidation D) None of the above

34. The compressibility of a field deposits it [ ]

A) The same as that shown by a laboratory sample

B) Greater than that shown by a laboratory sample

C) Smaller than that show by a laboratory

D) None

35. The co-efficient of Consolidation C is given by [ ]

A) $C=K/(\gamma m_V)$ B) $K=C/(\gamma m_V)$ C) $K=(\gamma m_V)/C$ D) $C=(\gamma m_V)/K$

36. Mathematically speaking, the time taken for 100% consolidation is [ ]

A) 5 years B) 10 years C) Zero D) Infinite

37. The ratio of settlement at any time t, to the final settlement is called as [ ]

A) Percentage settlement B) Partial settlement ratio

C) Degree of consolidation D) Residual consolidation

38. A clay deposit subject to pressure in the past which is more than the present over burden Pressure is known as [ ]

A) Normally consolidated soil B) Over-consolidated soil

C) Under-consolidated soil D) None of the above

39. Secondary consolidation is [ ]

A) Caused by hydrodynamic lag B) Caused by hydrostatic pressure

C) Caused by creep D) None

40. For a soil layer with double drainage and thickness H, the drainage path is equal to [ ]

A) 2H B) H/2 C) H^2 D) None of the above

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QUESTION BANK (DESCRIPTIVE)

Subject with Code : Geotechnical Engineering **(**16CE122) **Course & Branch**: B.Tech - CE

Year & Sem: III-B.Tech & I-Sem **Regulation:** R16

UNIT –V

1. Explain the principle of the direct shear test. What are the advantages of this test? What are its Limitations 10M

2. Briefly explain how you conduct the triaxial compression test? Compute the shear parameters for The soil from the test data 10M

3. Briefly explain how you conduct Unconfined compression Test 10M

4. Describe the vane shear test with neat a sketch 10M

5. Write brief critical notes on:
   (*a*) Mohr's Circle 5M
   (*b*) Explain the Mohr-Coulomb strength envelope 5M

6. The stresses at failure on the failure plane in a cohesionless soil mass were Shear stress = 4 kN/m^2; Normal stress = 10 kN/m^2. Determine the resultant stress on the failure plane, the angle of internal Friction of the soil and the angle of inclination of the failure plane to the major principal plane. 10M

7. Calculate the potential shear strength on a horizontal plane at a depth of 3 m below the surface in a Formation of cohesionless soil when the water table is at a depth of 3.5 m. The degree of saturation May be taken as 0.5 on the average. Void ratio = 0.50; grain specific gravity = 2.70; angle of internal Friction = 30°. What will be the modified value of shear strength if the water table reaches the Ground surface? 10M

8. A particular soil failed under a major principal stress of 300 kN/m^2 with a corresponding minor Principal stress of 100 kN/m^2. If, for the same soil, the minor principal stress had been 200 kN/m^2, Determine what the major principal stress would have been if (*a*) φ = 30° and (*b*) φ = 0°. 10M

9 A triaxial compression test on a cohesive sample cylindrical in shape yields the following effective Stresses:
   Major Principal stress ... 8 MN/m^2
   Minor principal stress ... 2 MN/m^2
   Angle of inclination of rupture plane is 60° to the horizontal. Present the above data, by means of a Mohr's circle of stress diagram. Find the cohesion and angle of internal friction. 10M

10. A vane, 10.8 cm long, 7.2 cm in diameter, was pressed into a soft clay at the bottom of a bore hole. Torque was applied and the value at failure was 45 Nm. Find the shear strength of the clay on a Horizontal plane. 10M

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QUESTION BANK (OBJECTIVE)

Subject with Code : Geotechnical Engineering **(**16CE122) **Course & Branch**: B.Tech - CE

Year & Sem: III-B.Tech & I-Sem **Regulation:** R16

UNIT –V

1. Shearing strength of cohesion less soil depends upon [ ]

A) Dry density B) Void ratio C) Loading rate D) Normal stress

2. Vane shear test is used for [ ]

A) Measuring shear strength of cohesive soil B) Measuring void ratio of sandy soils

C) Measuring bearing capacity of soils D) All the above

3. The effective stress is [ ]

A) Zero B) 90 C) Limited to a maximum of 45 D) All the above

4. Unconfined compression test is generally done on saturated clays for which the apparent angle of shearing resistance is [ ]

A) 0 B) 15^0 C) $22\ 1/2^0$ D) 30^0

5. Unconfined compression strength is obtained from [ ]

A) Under B) Drained test C) Slow test D) Consolidated drained test

6. In the unconfined compression strength, the corrected area of cross-section (A_C) at any strain can be calculated by [ ]

A) $A_C = A_0$ B) $A_C = \frac{A0}{1+\varepsilon}$ C) $A_C = A_0 (1-\varepsilon)$ D) $A_C = \frac{A0}{1-\varepsilon}$

7. If a clayey soil specimen is subject to a vertical compressive load, the angle by tracks

With the horizontal is [ ]

A) Zero B) 45^0 C) 90^0 D) 180^0

8. The unconfined compression test can be conducted on [ ]

A) Sandy B) Clayey C) Both sandy and clayey soils D) None

9. The angle between the two planes on which the shearing stress is zero is [ ]

A) Zero B) 30^0 C) 45^0 D) 90^0

10. In Mohr's circle the angle made by the plane which consists of maximum shear stress with horizontal at origin of planes is [ ]

A) Zero B) 45^0 C) 90^0 D) 180^0

11. The maximum shear stress in case of Mohr's circle will be numerically equal to [ ]

A) 1 B) 3 C) $\frac{(\sigma 1-\sigma 3)}{2}$ D) $\frac{(\sigma 1+\sigma 3)}{2}$

12. The shear stress on two planes which are at right angles to each other are [ ]

A) Numerically equal and of the same sign B) Numerically equal and are of the opposite sign

C) Not equal D) Can't say

13. The shape of plot between shear and normal stresses according to Mohr's theory is [ ]

A) Straight line B) Curve C) Elliptical D) All

14. Expansion of soils under shear is known as [ ]

A) Liquefaction B) Volumetric deformation C) Critical expansion D) Dilatancy

15. In a strain-controlled shear test [ ]

A) The shear force is increased at a constant rat e B) The shearing strain increases at a given rate

C) Both a & b D) None

16. Undrained shear strength S_u of saturated clay tested in unconfined compression is given in term of Unconfined compressive strength q_u as [ ]

A) $S_u=\frac{1}{2} q_u$ B) $S_u= q_u$ C) $S_u=2 q_u$ D) $S_u= 3q_u$

17. Shear strength of soil is determined by the equation [ ]

A) $C=S+\sigma \tan \varphi$ B) $\sigma =C+S \tan \varphi$ C) $S=C+\sigma \tan \varphi$ D) None

18. The stress that is responsible for the mobilization of shearing strength of a soil [ ]

A) Total stress B) Effective stress C) Neutral stress D) None

19. The shear strength o f plastic undrained clay depends upon [ ]

A) Internal friction B) Cohesion C) Both a & b D) Neither a & b

20. Drainage conditions during test can be controlled best in [ ]

A) Direct shear test B) Vane shear test

C) Unconfined compression test D) Triaxial shear test

21. The type of test in which no significant volume changes are expected is [ ]

A) Consolidated drainage test B) Consolidated un drained test

C) Unconsolidated un drained test D) All the above

22. If the stress-strain curve of a clayey soil showed a peak, it can be [ ]

A) Normally consolidated clay B) Under consolidated clay

C) Over consolidated clay D) None

23. The type of shearing test in which there is a pre-determined failure plane [ ]

A) Direct shear test B) Triaxial test C) Vane shear test D) Unconfined compression test

24. The shear failure exhibited by loose sands is known as [ ]

A) Elastic failure B) Plastic failure C) Brittle failure D) None of the above

25. The shear failure exhibited by dense sands is known as [ ]

A) Elastic failure B) Plastic failure C) Brittle failure D) None of the above

26. Clays generally exhibit plasticity property when they are mixed with [ ]

A) Kerosene B) Oil C) HCL D) Water

27. The shear strength of sand s with the following shape will be more [ ]

A) Sharp edged particles B) Rounded edged particles C) Flat particles D) None

28. In a consolidated drained test on a normally consolidated clayey soils, the volume of The soil during the shearing will [ ]

A) Remain same B) Increase C) Decrease D) Can't say

29. The stress-stain curve of an over consolidated clay is similar to that of [ ]

A) Gravels B) Loose sands C) Silts D) Dense sands

30. In the triaxial test, the intermediated principal stress will be equal to [ ]

A) Major Principal stress B) Deviator stress

C) Minor principal stress D) Average of major and minor principal stresses

31. Vane shear test is a

A) Field test B) Laboratory test C) Both A&B D) None

32. Stress distribution on the failure plane in the case of a triaxial test is [ ]

A) Zigzag B) Non-uniform C) Uniform D) Can't say

33. In unconfined compression test, alround stress is [ ]

A) Equal to major principal stress B) Half the major principal stress

C) Equal to zero D) Equal to intermediated principal stress

34. The value of cohesion of saturated clay will be --------- times the value of confined Compression strength [ ]

A) 2 B) 1.0 C) 0.5 D) Zero

35. The phenomenon when the sand losses its shear strength due to oscillatory motion in Saturated condition is known as [ ]

A) Quick sand B) Plastic sand C) Liquefaction D) All the above

36. The strength envelope of a pure cohesive soil is [ ]

A) Vertical B) Inclined C) Horizontal D) Curvilinear

37. The direct shear test is ideally suited for conducting drained tests on [ ]

A) Cohesive soils B) Cohesion less soils C) Any soil D) Clayey soil

38. Unconfined compression test is generally performed on [ ]

A) Sandy soils B) Silty soils C) Intact saturated clay D) fissure clay

39. The shear strength of a soil is a function of [ ]

A) Cohesion only B) Angle of internal friction only

C) Normal stress also D) None of the above

40. The angle of inclination of the coulomb's failure envelope with the horizontal is called [ ]

A) Angle of repose B) Angle of friction C) Angle of internal friction D) Frictional resistance

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