

QUESTION BANK

CE6405 Soil Mechanics

UNIT 1- INTRODUCTION

PART - A (2 marks)

1. Distinguish between Residual and Transported soil. **(AUC May/June 2012)**
2. Give the relation between γ_{sat} , G , γ_w and e . **(AUC May/June 2012)**
3. A compacted sample of soil with a bulk unit weight of 19.62 kN/m^3 has a water content of 15 per cent. What are its dry density, degree of saturation and air content? Assume $G = 2.65$.
(AUC Apr/May 2010)
4. What are all the Atterberg limits for soil and why it is necessary? **(AUC Nov/Dec 2012)**
5. Define sieve analysis and sedimentation analysis and what is the necessity of these two analysis? **(AUC Nov/Dec 2012)**
6. Two clays A and B have the following properties:

Atterberg limits	Clay A	Clay B
Liquid limit	44 %	55%
Plastic limit	29%	35%
Natural water content	30%	50%

Which of the clays A or B would experience larger settlement under identical loads? Why?

(AUC Apr/May 2010)

7. Determine the maximum possible voids ratio for a uniformly graded sand of perfectly spherical grains. **(AUC Nov/Dec 2011)**
 8. What is a zero air voids line? Draw a compaction curve and show the zero air voids line. **(AUC Nov/Dec 2011)**
 9. What is porosity of a given soil sample? **(AUC Apr / May 2011)**
 10. What is water content in given mass of soil? **(AUC Apr / May 2011)**
 11. Define :
 - (a) Porosity
 - (b) Void ratio. **(AUC Nov/Dec 2010)**
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12. Define effective size of particle in sieve analysis. **(AUC Nov/Dec 2010)**
13. Write any two engineering classification system of soil. **(AUC Apr / May 2009)**
14. List any one expression for finding dry density of soils. **(AUC Apr / May 2009)**
15. Define water content and compaction.
16. What are the laboratory methods of determination of water content?
17. Define degree of saturation and shrinkage ratio.
18. Define specific gravity and density index.
19. What do understand from grain size distribution?
20. What are consistency limits of soil?
21. Define plasticity index, flow index and liquidity index.
22. What are the methods available for determination of in-situ density?
23. What is the function of A-line Chart in soil classification?
24. Write the major soil classifications as per Indian Standard Classification System.
25. Differentiate standard proctor from modified proctor test.

PART - B (16 marks)

1. Write down a neat procedure for determining water content and specific gravity of a given soil in the laboratory by using a pycnometer. **(AUC Nov/Dec 2012)**
2. Sandy soil in a borrow pit has unit weight of solids as 25.8 kN/m^3 , water content equal to 11% and bulk unit weight equal to 16.4 kN/m^3 . How many cubic meter of compacted fill could be constructed of 3500 m^3 of sand excavated from borrow pit, if required value of porosity in the compacted fill is 30%. Also calculate the change in degree of saturation. **(AUC Nov/Dec 2012)**
3. The following data on consistency limits are available for two soils A and B.

Sl.No.	Index	Soil A	Soil B
1	Plastic limit	16%	19%
2	Liquid limit	30%	52%
3	Flow index	11	06
4	Natural water content	32%	40%

Find which soil is

- More plastic.
- Better foundation material on remoulding.

(iii) Better shear strength as function of water content.

(iv) Better shear strength at plastic limit.

(AUC Apr/May 2010)

Classify the soil as per IS classification system. Do those soils have organic matter?

4. By three phase soil system, prove that the degree of saturation S (as ratio) in terms of mass unit weight (γ), void ratio (e), specific gravity of soil grains (G) and unit weight of water (γ_w) is given by the expression

$$\gamma = \frac{(G + e S) \gamma_w}{1 + e}$$

(AUC Apr/May 2010)

5. The mass of wet soil when compacted in a mould was 19.55 kN. The water content of the soil was 16%. If the volume of the mould was 0.95 m^3 . Determine (i) dry unit weight, (ii) Void ratio, (iii) degree of saturation and (iv) percent air voids. Take $G = 2.68$.

(AUC May/June 2012)

6. In a hydrometer analysis, the corrected hydrometer reading in a 1000 ml uniform soil suspension at the start of sedimentation was 28. After a lapse of 30 minutes, the corrected hydrometer reading was 12 and the corresponding effective depth 10.5 cm. the specific gravity of the solids was 2.68. Assuming the viscosity and unit weight of water at the temperature of the test as 0.001 Ns/m^2 and 9.81 kN/m^3 respectively. Determine the weight of solids mixed in the suspension, the effective diameter corresponding to the 30 minutes reading and the percentage of particle finer than this size.

(AUC May/June 2012)

7. An earthen embankment of 10^6 m^3 volume is to be constructed with a soil having a void ratio of 0.80 after compaction. There are three borrow pits marked A, B and C having soils with voids ratios of 0.90, 0.50 and 1.80 respectively. The cost of excavation and transporting the soil is Rs 0.25, Rs 0.23 and Rs 0.18 per m^3 respectively. Calculate the volume of soil to be excavated from each pit. Which borrow pit is the most economical? (Take $G = 2.65$).

(AUC Nov/Dec 2011)

8. A laboratory compaction test on soil having specific gravity equal to 2.67 gave a maximum dry unit weight of 17.8 kN/m^3 and a water content of 15%. Determine the degree of saturation, air content and percentage air voids at the maximum dry unit weight. What would be theoretical maximum dry unit weight corresponding to zero air voids at the optimum water content?

(AUC Nov/Dec 2011)

9. A soil sample has a porosity of 40 per cent. The specific gravity of solids is 2.70. calculate

i) Voids ratio

ii) Dry density and

iii) Unit weight if the soil is completely saturated.

(AUC Apr / May 2011)

10. A soil has a bulk unit weight of 20.11 kN/m^3 and water content of 15 percent. Calculate the water content of the soil partially dries to a unit weight of 19.42 kN/m^3 and the voids ratio remains unchanged.

(AUC Apr / May 2011)

11. Explain Standard Proctor Compaction test with neat sketches.

(AUC Nov/Dec 2010)

12. Soil is to be excavated from a borrow pit which has a density of 17.66 kN/m^3 and water content of 12%. The specific gravity of soil particle is 2.7. The soil is compacted so that water content is 18% and dry density is 16.2 kN/m^3 . For 1000 cum of soil in fill, estimate.

(i) The quantity of soil to be excavated from the pit in cum and

(ii) The amount of water to be added. Also determine the void ratios of the soil in borrow pit and fill. **(AUC Nov/Dec 2010)**

13. Explain all the consistency limits and indices. **(AUC Apr / May 2009)**

14. Explain in detail the procedure for determination of grain size distribution of soil by sieve analysis. **(8)** **(AUC Apr / May 2009)**

15. An earth embankment is compacted at a water content of 18% to a bulk density of 1.92 g/cm^3 . If the specific gravity of the sand is 2.7, find the void ratio and degree of saturation of the compacted embankment. **(8)** **(AUC Apr / May 2009)**

16. Explain the procedure for determining the relationship between dry density and moisture content by proctor compaction test.

UNIT 2- SOIL WATER AND WATER FLOW

PART - A (2 marks)

1. What are the different types of soil water? (AUC May/June 2012)
 2. List out the methods of drawing flow net. (AUC May/June 2012)
 3. What is meant by total stress, neutral stress and effective stress?(AUC Nov / Dec 2012)
 4. What is meant by capillary rise in soil and how it affects the stress level in soils?
(AUC Nov / Dec 2012)
 5. Prove that effective stress in soil mass is independent of variation in water table above the ground surface. (AUC Apr / May 2010)
 6. State and explain Darcy's law. (AUC Apr / May 2010)
 7. What is quick sand? How would you calculate the hydraulic gradient required to create quick sand conditions in a sample of sand? (AUC Nov/Dec 2011)
 8. For a homogeneous earth dam 52 m high and 2 m free board, a flow net was constructed and following results were obtained:
Number of potential drops = 25; Number of flow channels = 4
Calculate the discharge per metre length of the dam if the co-efficient of permeability of the dam material is 3×10^{-5} m/sec. (AUC Nov/Dec 2011)
 9. What is capillary rise? (AUC Apr / May 2011)
 10. What is surface tension? (AUC Apr / May 2011)
 11. What are the different forms of soil water? (AUC Nov/Dec 2010)
 12. Write down the uses of Flow net. (AUC Nov/Dec 2010)
 13. Define Neutral stress. (AUC Apr / May 2009)
 14. What is seepage velocity? (AUC Apr / May 2009)
 15. Define soil water and classify the types of soil water.
 16. Define Capillarity and permeability.
 17. What is surface tension?
 18. What is meant by capillary siphoning?
 19. Give the relationship between total, neutral and effective stress.
 20. What are the factors affecting permeability?
 21. What are the methods available for determination of permeability in the laboratory?
 22. Define discharge and seepage velocity.
 23. What are methods of determination of permeability in the field?
 24. Define seepage pressure and flow net.
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25. What is quick sand condition?

PART - B (16 marks)

1. The water table in a deposit of sand 8 m thick is at a depth of 3 m below the ground surface. Above the water table, the sand is saturated with capillary water. The bulk density of sand is 19.62 kN/m^3 . Calculate the effective pressure at 1m, 3m and 8m below the ground surface. Hence plot the variation of total pressure, neutral pressure and effective pressure over the depth of 8m.

(AUC Nov / Dec 2012)

2. Write down the procedure for determination of permeability by constant head test in the laboratory.

(AUC Nov / Dec 2012)

3. Compute the total, effective and pore pressure at a depth of 20 m below the bottom of a lake 6 m deep. The bottom of lake consists of soft clay with a thickness of more than 20 m. the average water content of the clay is 35% and specific gravity of the soil may be assumed to be 2.65.

(AUC Apr / May 2010)

4. 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 second layer are twice of those of the first and those of the third layer twice those of second?

(AUC Apr / May 2010)

5. The subsoil strata at a site consist of fine sand 1.8 m thick overlying a stratum of clay 1.6 m thick. Under the clay stratum lies a deposit of coarse sand extending to a considerable depth. The water table is 1.5 m below the ground surface. Assuming the top fine sand to be saturated by capillary water, calculate the effective pressures at ground surface and at depths of 1.8 m, 3.4 m and 5.0 m below the ground surface. Assume for fine sand $G = 2.65$, $e = 0.8$ and for coarse sand $G = 2.66$, $e = 0.5$. What will be the change in effective pressure at depth 3.4 m, if no capillary water is assumed to be present in the fine sand and its bulk unit

weight is assumed to be 16.68 kN/m^3 . The unit weight of clay may be assumed as 19.32 kN/m^3 .

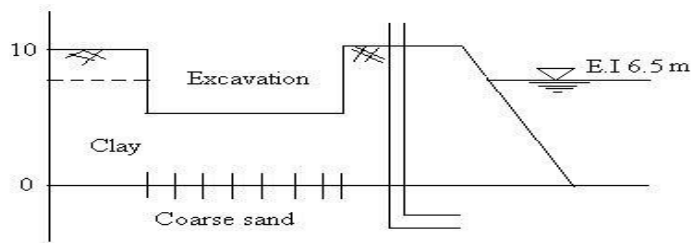
(AUC May/June 2012)

6. In a constant head permeameter test, the following observations were taken. Distance between piezometer tapings = 15 cm, difference of water levels in piezometers = 40 cm, diameter of the test sample = 5 cm, quantity of water collected = 500 ml, duration of the test = 900 sec. determine the coefficient of permeability of the soil. If the dry mass of the 15 cm long sample is 486 g and specific gravity of the solids is 2.65. Calculate seepage velocity of water during the test.

(AUC May/June 2012)

7. A foundation trench is to be excavated in a stratum of stiff clay, 10m thick, underlain by a bed of coarse sand (fig.1.). In a trial borehole the ground water was observed to rise to an elevation of 3.5m below ground surface. Determine the depth upto which an excavation can be safely carried out without the danger of the bottom becoming unstable under the artesian pressure in the sand stratum. The specific gravity of clay particles is 2.75 and the void ratio is 0.8. if excavation is to be carried out safely to a depth of 8m, how much should the water table be lowered in the vicinity of the trench?





(AUC Nov/Dec 2011)

8. The following data were recorded in a constant head permeability test.
Internal diameter of permeameter = 7.5cm

Head lost over a sample length of 18cm = 24.7cm

Quantity of water collected in 60 Sec = 626 ml

Porosity of soil sample was 44%

Calculate the coefficient of permeability of the soil. Also determine the discharge velocity and seepage velocity during the test.

(AUC Nov/Dec 2011)

9. Explain the falling head permeability test. (8)

(AUC Apr / May 2011)

10. What are the applications of flow net and explain briefly?

(AUC Apr / May 2011)

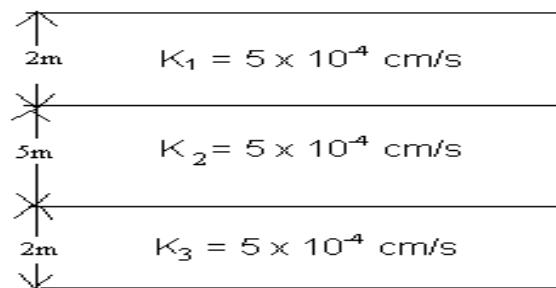
(AUC Nov/Dec 2010)

11. Determine the effective stress at 2m, 4m, 6m, 8m and 10m in a soil mass having $\gamma_s = 21 \text{ KN/m}^3$. Water table is 2m below ground surface. Above water table there is capillary rise upto ground surface. Also draw total stress diagram up to 10m.

(AUC Apr / May 2011)

12. A stratified soil deposit is shown in Fig.1. Along with the coefficient of permeability of the individual strata. Determine the ratio of K_H and K_V . Assuming an average hydraulic gradient of 0.3 in both horizontal and vertical seepage, Find

- Discharge value and discharge velocities in each layer for horizontal flow and
- Hydraulic gradient and loss in head in each layer for vertical flow.



(AUC Nov/Dec 2010)

13. Explain any four methods of obtaining flow nets.

(AUC Apr / May 2009)

14. The discharge of water collected from a constant head permeameter in a period of 15 minutes is 500 ml. the internal diameter of the permeameter is 5 cm and the measured

difference in head between two gauging points 15 cm vertically apart is 40 cm. calculate the coefficient of permeability. If the dry weight of the 15 cm long sample is 486 gm and the specific gravity of the solids is 2.65, calculate the seepage velocity. **(AUC Apr / May 2009)**

15. Explain in detail the laboratory determination of permeability using constant head method and falling head method. 16. Explain in detail the procedure for drawing the phreatic line for an earthen dam.

UNIT 3 – STRESS DISTRIBUTION, COMPRESSIBILITY AND SETTLEMENT

PART – A (2 marks)

1. Write down Boussinesque equation for finding out the vertical stress under a single concentrated load. **(AUC Nov / Dec 2012)**
 2. Define normally consolidated clays and over consolidated clays. **(AUC Nov / Dec 2012)**
 3. Explain the method of estimating vertical stress using Newmark's influence chart. **(AUC Apr / May 2010)**
 4. What are the assumptions made in Terzaghi's one dimensional consolidation theory? **(AUC Apr / May 2010)**
 5. What is the use of influence chart in soil mechanics? **(AUC May/June 2012)**
 6. Differentiate between 'Compaction' and 'Consolidation'. **(AUC May/June 2012)**
 7. Write down the use of influence charts. **(AUC Nov/Dec 2011)**
 8. What are isochrones? **(AUC Nov/Dec 2011)**
 9. When a soil mass is said to be homogeneous? **(AUC Apr / May 2011)**
 10. What are isobars? **(AUC Apr / May 2011)**
 11. Differentiate Consolidation and Compaction. **(AUC Nov/Dec 2010)**
 12. List the components of settlement in soil. **(AUC Nov/Dec 2010)**
 13. What are the two theories explaining the stress distribution on soil? **(AUC Apr / May 2009)**
 14. What is oedometer? **(AUC Apr / May 2009)**
 15. What is geostatic stress and pre-consolidation pressure?
 16. What are the applications of Boussinesque equation?
 17. What is a pressure bulb and Newmark's Chart?
 18. Write the equation for stress in soil due to a uniformly loaded circular area.
 19. Write the equation for stress in soil due to a line load.
 20. Write the equation for stress in soil beneath a corner of a uniformly loaded rectangular area.
 21. Write the Westergaard's equation for stress beneath a concentrated point load.
 22. Define co-efficient of compressibility and compression index.
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23. What are the methods to determine co-efficient of consolidation?

24. What are the factors influencing consolidation?

25. Define Over consolidation ratio and creep.

PART – B (16 marks)

1. 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 depth of 4 m, below the centre of ring foundation, using

(i) Boussinesque analysis and

(ii) Westergaard's analysis, taking $\mu = 0$

(AUC Apr / May 2010)

2. A stratum of clay with an average liquid limit of 45% is 6m thick. Its surface is located at a depth of 8m below the ground surface. The natural water content of the clay is 40% and the specific gravity is 2.7. Between ground surface and clay, the subsoil consists of fine sand. The water table is located at a depth of 4m below the ground surface. The average submerged unit weight of sand is 10.5 kN/m^3 and unit weight of sand above the water table is 17 kN/m^3 . The weight of the building that will be constructed on the sand above clay increases the overburden pressure on the clay by 40 kN/m^2 . Estimate the settlements of the building.

(AUC Apr / May 2010)

3. A concentrated point load of 200 kN acts at the ground surface. Find the intensity of vertical pressure at a depth of 10 m below the ground surface and situated on the axis of the loading. What will be the vertical pressure at a point at a depth of 5 m and at a radial distance of 2 m from the axis of loading? Use Boussinesque analysis. **(AUC Nov / Dec 2012)**

4. Explain with a neat sketch the Terzaghi's one dimensional consolidation theory.

(AUC Nov / Dec 2012)

(AUC May/June 2012)

5. The load from a continuous footing of width 2m, which may be considered to be strip load of considerable length, is 200 kN/m^2 . Determine the maximum principal stress at 1.5m depth below the footing, if the point lies (i) directly below the centre of the footing, (ii) directly below the edge of the footing and (iii) 0.8m away from the edge of the footing. **(AUC May/June 2012)**

6. What are different components of settlement? Explain in detail. **(AUC May/June 2012)**

7. In a laboratory consolidometer test on a 20 mm thick sample of saturated clay taken from a site, 50% consolidation point was reached in 10 minutes. Estimate the time required for the clay

layer of 5 m thickness at the site for 50% compression if there is drainage only towards the top. What is the time required for the clay layer to reach 50% consolidation if the layer has double drainage instead of single drainage. **(AUC Nov/Dec 2011)**

8. What are the various components of a settlement? How are these estimated?

(AUC Nov/Dec 2011)

9. Explain the Newmark's influence chart in detail.

(AUC Apr / May 2011)

10. How will you determine preconsolidation pressure? **(6)**

(AUC Apr / May 2011)

11. How will you determine coefficient of compression index (C_c) from an oedometer test? **(10)**

(AUC Apr / May 2011)

12. An undrained soil sample 30cm thick got 50% consolidation in 20 minutes with drainage allowed at top and bottom in the laboratory. If the clay layer from which the sample was obtained is 3m thick in field condition, estimate the time it will take to consolidate 50% with double surface drainage and in

both cases, consolidation pressure is uniform.

(AUC Nov/Dec 2010)

13. Derive Boussinesque equations to find intensity of vertical pressure and tangential stress when a concentrated load is acting on the soil.

(AUC Nov/Dec 2010)

14. Explain the assumptions made by Boussinesque in stress distribution on soils. (8)

(AUC Apr / May 2009)

15. A line load of 100 kN/m run extends to a long distance. Determine the intensity of vertical stress at a point, 2 m below the surface and

i) Directly under the line load and

ii) At a distance 2 m perpendicular to the line.

Use Boussinesq's theory. (8)

(AUC Apr / May 2009)

16. Explain in detail the laboratory determination of co-efficient of consolidation. (8)

(AUC Apr / May 2009)

17. A layer of soft clay is 6 m thick and lies under a newly constructed building. The weight of sand overlying the clay layer produces a pressure of 2.6 kg/cm^2 and the new construction increases the pressure by 1.0 kg/cm^2 . If the compression index is 0.5. Compute the settlement.

Water content is 40% and specific gravity of grains is 2.65. (8)

(AUC Apr / May 2009)

Unit 4 - SHEAR STRENGTH

PART - A (2 marks)

1. Write down the Mohr's-Coulomb failure envelope equation. (AUC Nov / Dec 2012)
 2. Why triaxial shear test is considered better than direct shear test? (AUC Nov / Dec 2012)
 3. What are different types of triaxial compression tests based on drainage conditions?
(AUC Apr / May 2010)
 4. Explain the Mohr-Coulomb failure theory. (AUC Apr / May 2010)
 5. State the principles of Direct shear test? (AUC May/June 2012)
 6. What is the effect of pore pressure on shear strength of soil? (AUC May/June 2012)
 7. How will you find the shear strength of cohesionless soil? (AUC Nov/Dec 2011)
 8. List out the types of shear tests based on drainage. (AUC Nov/Dec 2011)
 9. What is shear strength of soil? (AUC Apr / May 2011)
 10. Write down the Coulomb's expression for shear strength. (AUC Apr / May 2011)
 11. How will you find the shear strength of cohesive soil? (AUC Nov/Dec 2010)
 12. What are the advantages of Triaxial Compression Test? (AUC Nov/Dec 2010)
 13. Define 'angle of repose' of soil. (AUC Apr / May 2009)
 14. Write the expression for coulomb's law. (AUC Apr / May 2009)
 15. Define shear strength and failure envelope.
 16. What are the shear strength parameters?
 17. Define Cohesion and stress path.
 18. What is angle of internal friction?
 19. What are the various methods of determination of shear strength in the laboratory?
 20. Write the differential equation of deflection of a bent beam?
 21. What are the disadvantages of direct shear test?
 22. What are the types of triaxial test based on drainage conditions?
 23. When is vane shear test adopted?
 24. Sketch the Mohr's circle for total and effective stresses for undrained triaxial test.
 25. Sketch the failure envelope for drained triaxial test.
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PART – B (16 marks)

1. Obtain the relationship between the principal stresses in triaxial compression test using Mohr-Coulomb failure theory. **(AUC Apr / May 2010)**
 2. Two identical soil specimens were tested in a triaxial apparatus. First specimen failed at a deviator stress of 770 kN/m^2 when the cell pressure was 2000 kN/m^2 . Second specimen failed at a deviator stress of 1370 kN/m^2 under a cell pressure of 400 kN/m^2 . Determine the value of c and Φ analytically. If the same soil is tested in a direct shear apparatus with a normal stress of 600 kN/m^2 , estimate the shear stress at failure. **(AUC Apr / May 2010)**
 3. A saturated specimen of cohesion less sand was tested in triaxial compression and the sample failed at a deviator stress of 482 kN/m^2 when the cell pressure was 100 kN/m^2 under the drained conditions. Find the effective angle of shearing resistance of sand. What would be the deviator stress and the major principal stress at failure for another identical specimen of sand, if it is tested under cell pressure of 200 kN/m^2 . Use either Mohr's circle method or analytical method. **(AUC Nov / Dec 2012)**
 4. Write down a step by step procedure for determination of cohesion of a given clayey soil by conducting unconfined compression test. **(AUC Nov / Dec 2012)**
 5. Explain with neat sketches the procedure of conducting direct shear test. Give its advantages over other methods of finding shear strength of soil. **(AUC May/June 2012)**
 6. (i) Write a brief critical note on unconfined compression test. **(AUC May/June 2012)**
(ii) What are the advantages and disadvantages of triaxial compression test. **(AUC May/June 2012)**
 7. A vane, 10 cm long and 8 cm in diameter, was pressed into soft clay at the bottom of a bore hole. Torque was applied and gradually increased to 45 N-m when failure took place. Subsequently, the vane rotated rapidly so as to completely remould the soil. The remoulded soil was sheared at a torque of 18 N-m. Calculate the cohesion of the clay in the natural and remoulded states and also the value of the sensitivity. **(AUC Nov/Dec 2011)**
 8. Describe the triaxial shear test. What are the advantages of triaxial shear test over the direct shear test? **(AUC Nov/Dec 2011)**
 9. Explain the Triaxial compression test to determine the shear strength of soil. (8) **(AUC Apr / May 2011)**
 10. Explain drained behavior of clay with reference to shear strength. (8) **(AUC Apr / May 2011)**
 11. Explain the direct shear test to determine the shear strength of soil. (8) **(AUC Apr / May 2011)**
 12. Explain the Mohr-Coulomb failure theory. (8) **(AUC Apr / May 2011)**
 13. Explain with neat sketch Direct Shear method of finding Shear Strength. **(AUC Nov/Dec 2010)**
(AUC Apr / May 2009)
 14. The following data were obtained in a direct shear test. Normal pressure 20 kN/m^2 , Tangential pressure = 16 kN/m^2 , Angle of internal friction = 20° , Cohesion = 8 kN/m^2 . Represent the data by Mohr's circle and compute the principal stresses and the direction of principal planes. (8) **(AUC Apr / May 2009)**
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15. Compare the merits and demerits of triaxial compression test. (8) (AUC Apr / May 2009)

16. 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 (i) $\Phi = 30^\circ$ and

(ii) $\Phi = 0^\circ$. (8)

(AUC Apr / May 2009)

17. A Cylindrical specimen of dry sand was tested in a triaxial test. Failure occurred under a cell pressure of 1.2 kg/cm^2 and at a deviator stress of 4.0 kg/cm^2 . Find

(i) Angle of shearing resistance of the soil.

(ii) Normal and shear stresses on the failure plane.

(iii) The angle made by the plane with the minor principal plane.

(iv) The maximum shear stress on any plane in the specimen at the instant of failure.

(AUC Nov/Dec 2010)

18. Explain in detail the determination of shear strength using unconfined compression test.

19. Explain in detail the determination of shear strength using vane shear test.

20. Explain the shear strength behavior of cohesive and cohesionless soils under different drainage condition in a triaxial test.

Unit 5 – SLOPE STABILITY

PART – A (2 marks)

1. Differentiate finite slope and infinite slope. (AUC Nov / Dec 2012)
(AUC Apr / May 2010)
2. Write down the expression for factor of safety of an infinite slope in case of cohesion less soil. (AUC Apr / May 2010)
3. List out any two slope protection methods. (AUC Nov / Dec 2012)
4. What do you mean by Tension crack? (AUC May/June 2012)
5. Define critical surface of failure. (AUC May/June 2012)
6. What are different factors of safety used in the stability of slopes? (AUC Nov/Dec 2011)
7. What is a stability number? What are the uses of stability charts? (AUC Nov/Dec 2011)
8. State the two basic types of failure occurring in finite slopes. (AUC Apr / May 2011)
9. What is a slide? (AUC Apr / May 2011)
10. What are the different types of Slope failure? (AUC Nov/Dec 2010)
11. State some of the Slope protection measures. (AUC Nov/Dec 2010)
12. Mention the types of slopes in soil. (AUC Apr / May 2009)
13. Define stability number. (AUC Apr / May 2009)
14. What are the types of slopes?
15. What are the types and causes for slope failure?
16. What are the various methods of analysis of finite slopes?
17. Define factor of safety and critical depth.
18. Define stability number.
19. How does tension crack influence stability analysis?
20. What are the various slope protection measures?

PART – B (16 marks)

1. Explain the procedure to calculate the factor of safety of a finite slope possessing both cohesion and friction ($c - \Phi$) by method of slices. (AUC Apr / May 2010)
 2. A slope is to be constructed in a soil for which $c = 0$ and $\Phi = 36^\circ$. It is to be assumed that the water level may occasionally reach the surface of a slope with seepage taking place parallel to the slope. Determine the maximum slope angle for a factor of safety 1.5, assuming a potential failure surface parallel to the slope. What would be the factor of safety of the slope, constructed at this angle, if the water table should be below the surface? The
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saturated unit weight of the soil is 19 kN/m^3 .

(AUC Apr / May 2010)

3. A new canal is excavated to a depth of 5 m below ground level through a soil having the following characteristics: $C = 14 \text{ kN/m}^2$; $\Phi = 15^\circ$; $e = 0.8$ and $G = 2.70$. The slope of banks is 1 in 1. Calculate the factor of safety with respect to cohesion when the canal runs full. If it is suddenly and completely emptied, what will be the factor of safety? **(AUC Nov / Dec 2012)**
 4. Write down the procedure for determining the factor of safety of a given slope by friction circle method. **(AUC Nov / Dec 2012)**
 5. A canal is to be excavated to a depth of 6m below ground level through a soil having the following characteristics $c = 15 \text{ kN/m}^2$, $\Phi = 20^\circ$, $e = 0.9$ and $G = 2.67$. The slope of the banks is 1 in 1. Determine the factor of safety with respect to cohesion when the canal runs full. What will be the factor of safety if the canal is rapidly emptied completely? **(AUC May/June 2012)**
 6. Explain with neat sketches the Bishop's method of stability analysis. **(AUC May/June 2012)**
(AUC Nov/Dec 2010)
 7. What are different types of slope failures? Discuss the various methods for improving the stability of slopes. **(AUC Nov/Dec 2011)**
 8. An embankment 10 m high is inclined at 35° to the horizontal. A stability analysis by the method of slices gave the following forces: $\sum N = 900 \text{ kN}$, $\sum T = 420 \text{ kN}$, $\sum U = 200 \text{ kN}$. If the length of the failure arc is 23.0 m, find the factor of safety. The soil has $c = 20 \text{ kN/m}^2$ and $\Phi = 15^\circ$. **(AUC Nov/Dec 2011)**
 9. Explain the Swedish slip circle method in detail. **(10)** **(AUC Apr / May 2011)**
(AUC Nov/Dec 2010)
 10. Explain Taylor's stability number and its applicability. **(6)** **(AUC Apr / May 2011)**
 11. Explain in detail the friction circle method of stability analysis for slopes with sketch. **(AUC Apr / May 2011)**
(AUC Apr / May 2009)
 12. Explain any four methods of slope protection. **(8)** **(AUC Apr / May 2011)**
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13. A cut 9 m deep is to be made in clay with a unit weight of 18 kN/m^3 and cohesion of 27 kN/m^2 . A hard stratum exists at a depth of 18 m below the ground surface. Determine from Taylor's charts if a 30° slope is safe. If a factor of safety of 1.50 is desired, what is a safe angle of slope? **(AUC Apr / May 2009)**

14. Explain in detail the various methods to protect slopes from failure.
