Reg. No._____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2017

CE208: GEOTECHNICAL ENGINEERING I (CE)

Max.Marks : 100 Duration : 3 Hours

(Assume any missing data, Graph sheets can be used.)

PART A

Answer any two questions in full.

1. (a) Using phase diagram, define the terms (i) void ratio (ii) Degree of saturation (iii) water content and (iv) specific gravity. (7)

   (b) A partially saturated soil sample obtained from an earth fill has a natural water content of 26% and unit weight 19.74 kN/ m^3. Assuming specific gravity of solids is 2.68. Compute: (i) Degree of saturation (ii) void ratio (iii) porosity and (iv) air content. (8)

2. (a) Sketch the plasticity chart used for classifying fine grained soil according to IS classification system. Give the group symbol for the following soil according to IS classification system

   i) percentage of soil passing 75 micron sieve = 3%

   ii) Percentage of coarse fraction passing 4.75 mm sieve = 70%

   iii) Uniformity coefficient = 7

   iv) Co efficient of curvature = 3 (7)

   (b) What is the use of particle size distribution curve? With the help of particle size distribution curve define the following terms (i) well graded soil (ii) poorly graded soil (iii) gap graded soil and (iv) effective size. (8)

3. (a) Following are the results obtained from the liquid and plastic limit tests for a soil.

   Observations of liquid limit:

No. of blows	Moisture content(%)
13	27
18	23
29	22

The plastic limit is 15.5%. (i) draw the flow curve and obtain the liquid limit (ii) Determine the liquidity index of soil when the insitu moisture content is 18% (iii) Plasticity index . (7)

(b) Differentiate between (i) sensitivity and thixotropy (ii) consistency index and flow index (iii) Density index and density (iv) Absolute specific gravity and apparent specific gravity. (8)

PART B

Answer any two questions in full.

4. (a) The following data were recorded in a constant head permeability test. Internal diameter of permeameter = 7.5 cm. Head loss over a sample length of 18cm. = 24.7cm. Quantity of water collected in 60sec. = 626 ml. porosity of the soil sample was 44%, calculate the coefficient of permeability of the soil. Also, determine the seepage velocity during the test. (7)

   (b) A layer of saturated clay 4m. thick is overlain by sand 5m. deep the water table being 3m. below the surface. The saturated unit weights of the clay and sand are 19 and 20 kN/m^3 respectively, and the unit weight of sand above water table is $17kN/m^3$. Determine the values of total vertical stress and effective vertical stress at the bottom and interface layers. Also, plot their variations. (8)

5. (a) A shear box test on clean sand gave a failure stress of 70 kPa when the normal stress was 200kPa. Draw the Mohr circle and Mohr envelope and find the principal stresses at failure and the orientation of the principal planes. (7)

   (b) The results of a triaxial shear tests are given below:

Specimen No.	1	2
Minor principal Stress (σ_3)(kN/m^2)	17	44
Major principal stress(σ_1) (kN/m^2)	157	204
Pore pressure (U) (kN/m^2)	12	20

   Determine the shear strength parameters using effective stress analysis. (8)

6. (a) State Mohr-Coloumb theory. What are the different methods for finding out the shear parameters? Explain with figure the field method for finding out shear strength of soil. (7)

(b) Define the terms (i) quick sand condition (ii) exit gradient (iii) phreatic line and (iv) UU test. (8)

PART C

Answer any two questions in full.

7. (a) A 20 mm. thick specimen of soil takes 16 minutes to reach 50% consolidation in the laboratory when drainage is permitted from both ends. Calculate the coefficient of consolidation. Also, calculate the time required for 90% consolidation for the above sample. How much time will it take for 90% consolidation of 4m. thick similar sample in the field with double drainage? Also, calculate the time when drainage is permitted only from one side. (10)

   (b) A stratum of clay 8m. deep has w_L= 45%. The surface of clay is at 10m. below the present ground level, w = 40% and G = 2.78 for clay. Between ground surface and clay, the subsoil consists of fine sand. The ground water level is 4.5m. below ground level. The average submerged unit weight of sand is 10.4kN/m^3 and the unit weight of sand above the ground water level is 17kN/m^3. The clay is normally consolidated. The weight of structure coming on top of the sand above the clay increases the overburden pressure on clay by 40kN/m^2. Estimate the settlement of the building. (10)

8. (a) Explain the Swedish circle method for the analysis of slopes for a c-Ø soil. (10)

   (b) A proctor compaction test was conducted on a soil sample, and the following observations were made:

Water content(%)	8	11.5	14.5	17.5	19.5
Weight of wet soil (kg)	1.7	1.9	2.00	1.98	1.95

   If the volume of the mould used was 950cc and the specific gravity of the soil was 2.65, draw the dry density vs moisture content curve and find the optimum moisture content and maximum dry density. Also draw the zero air void line. (10)

9. (a) Explain the consolidation phenomenon using Terzaghi's spring analogy. (6)

   (b) (i)What is meant by stability number and stability chart? (ii) What are the different types of slope failures? (7)

   (c) What is meant by pre consolidation pressure? Explain the method for the estimation of pre consolidation pressure. (7)

Total Pages: 2

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

Course Code: CE208

Course Name: GEOTECHNICAL ENGINEERING I (CE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions. Each carries 15 marks.

1	a)	What are the major soil deposits of India?	(5)
	b)	Derive the relationship between dry density, Υ_d and Bulk density, Υ of soil.	(5)
	c)	A moist soil sample of soil has a mass of 700 g and a volume of 200 cc at a water content of 10 %. Determine the Void ratio, Degree of Saturation and Percentage air voids Also determine the water content at which the soil gets fully saturated without any increase in volume	(5)
2	a)	What is a gradation curve? Sketch the gradation curves for Well graded and Gap graded soils?	(4)
	b)	A soil sample consisting of particles of size ranging from 0.1 mm to 0.01mm, is put on the surface of still water tank 6 m deep. Calculate the time of settlement of the coarsest and finest particles of the sample to the bottom of the tank. Specific gravity of soil = 2.66, Viscosity of water = 0.008 poise.	(5)
	c)	Explain the IS classification of soils.	(6)
3	a)	Define the following terms: - i) Activity ii) Thixotropy	(4)
	b)	The Liquid limit of a soil sample is 46 % and Plastic limit is 27%. Classify the soil using a Plasticity chart.	(5)
	c)	The Atterberg limits of a soil sample are LL= 52 %, PL = 33% and SL = 17%. If the specimen of the soil shrinks from a volume of 11.5 cc at Liquid limit to 6.2 cc when it is oven dried. Calculate: - i) Shrinkage ratio ii) specific gravity of soil solids	(6)

PART B

Answer any two full questions. Each carries 15 marks.

4	a)	State Darcy's law and explain the validity of the law	(4)
	b)	Find the average horizontal and vertical permeabilities of a soil mass made up of three horizontal layers. The first and second layer have same thickness of 0.6 m each and third layer is 0.8 m thick. The coefficient of permeability of first, second and third layer are 2×10^{-4}cm/s, 2.5×10^{-5}cm/s and 1.2×10^{-4}cm/s respectively.	(5)
	c)	Explain Mohr Coulomb failure criteria. Also draw the failure envelope for: - i) Pure sand ii) Pure clay	(6)
5	a)	What is UU and CD tests?	(4)
	b)	What are the factors affecting Coefficient of Permeability?	(5)

c) In a deposit of sand 10 m thick, water table is 2m below ground surface. Above the water table, soil is saturated with capillary water. Saturated unit weight of sand is 21 kN/m^3.Plot the variation of Total stresses, Neutral stresses and Effective stresses over the depth of 10m. (6)

6 a) Explain the quick sand condition (5)

b) The Triaxial tests conducted on four identical soil sample specimens gave the following results. (10)

Cell pressure in kN/m^2	100	150	200	250
Deviator stress in kN/m^2	300	420	515	607
Neutral stress in kN/m^2	6	12	14	16

Determine the shear parameters in terms of: -

i) Total stresses ii) Effective stresses

PART C

Answer any two full questions. Each carries 20 marks.

7 a) Define (5)

i) Normally consolidated clay ii) Over consolidated clay

b) A clay layer 4m thick is sandwiched between layer of sand at top and impermeable strata at bottom. Calculate the time taken by clay layer to reach 40 % consolidation, if coefficient of consolidation is 2x 10^{-4} cm/s. (5)

c) Explain the Friction circle method for slope stability analysis. (10)

8 a) What are the different types of slope failure? (5)

b) What is meant by control of compaction (5)

c) A saturated clay sample of height 25mm, cross sectional area 50 cm^2 was subjected to a consolidation test and the results are as follows. Height of solids = 14.25mm. Final water content = 25%. Find the void ratio at various load increments by Height of solids method. (10)

Pressure in kN/m^2	0	10	20	40	80	160	320	640	0
Dial reading	490	482	470	431	390	343	295	249	350

9 a) A clay stratum 2m thick is subjected to an overburden pressure of 150 kN/m^2. Estimate the probable settlement of the clay layer if effective pressure at centre of clay layer is expected to increase to 345 kN/m^2. The slope of e- log p curve is 0.09. The initial void ratio is 1.12. (5)

b) What are the uses of Stability number and Stability charts? (5)

c) Explain about the standard proctor test. (10)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CE208

Course Name: GEOTECHNICAL ENGINEERING I (CE)

Max. Marks: 100 Duration: 3 Hours

(Graph sheets may be supplied on request)

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) The wet unit weight of a clay sample is 18.8kN/m^3 at 20% water content. What is the degree of saturation? (5)

b) An embankment of $10^3 m^3$ volume is to be constructed with a soil having a void ratio of 0.8 after compaction. There are three borrow pits marked A, B and C having soils with void ratios of 0.9, 1.5 and 1.8 respectively. The cost of excavation and transporting the soil is Rs. 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 most economical? (10)

2 a) What are the index properties of soil? Why are they important? (5)

b) A partially saturated clay weighs 113.4 gm in its natural state and 93.4g in its dry state. If specific gravity is 2.65, find out the void ratio, porosity, degree of saturation, γ_{wet}, γ_d and γ_{sat}. Size of the clay is 3.7 cm in dia. and 7.5 cm ht. (10)

3 a) What are the different corrections applied to hydrometer reading? (5)

b) In a hydrometer analysis 50 g of soil was mixed in water to form 1000ml uniform soil suspension. The corrected hydrometer reading after a lapse of 60mts from the start of sedimentation was 1.010 and the corresponding effective depth was 108 mm. Determine the effective diameter corresponding to 60mts reading and percentage of particles finer than this size. G= 2.7 viscosity of water is 0.001 Ns/$m^{2.}$ (10)

PART B

Answer any two full questions, each carries 15 marks

4 a) Explain the effect of capillarity on effective stress. (5)

b) A bed of sand consists of three horizontal layers of equal thickness. The magnitude of the coefficient of permeability for both upper and lower layer is $4X10^{-4}$mm/s and for the middle layer, it is $6x10^{-2}$mm/s. what is the ratio of the average permeability of the bed in the horizontal direction to that in vertical direction. (10)

5 a) List the demerits of direct shear test. (5)

b) The following data refers to a CU test on a normally consolidated clay. Compute the total stress and effective shear strength parameters. (10)

Sample no	Cell pressure (kPa)	Deviator stress (kPa)	Pore pressure (kPa)
1	100	130	48
2	300	485	140
3	500	645	290

6 a) Explain effective stress principle. (5)

b) A saturated specimen is permanently under water. Its water content is 50% and G=2.72. What is the effective stress at 8 m below the clay surface? How many meters of clay must be removed by dredging to reduce the intergranular pressure at that point by 25 kPa. The water levels remain unchanged. (10)

PART C

Answer any two full questions, each carries 20 marks

7 a) What are the different types of finite slopes? Give measures for improving the stability of slopes. (10)

b) Explain Friction circle method of slope stability analysis. (10)

8 a) A 20 m thick isotropic clay stratum overlies an impervious rock. The coefficient of consolidation is $5x10^{-2}mm^2/s$. Find the time required for 50% and 90% consolidation. The time factor for 50% consolidation is 0.2 and for 90% consolidation is 0.85 (10)

b) At a building site soil consist of dense sand upto a depth of 3m, clay from 3m to 6m depth and stiff impervious rock below 6m depth. The water table is at 1m below the present ground level. Density of sand is 19.5 kN/m^3 above water table and 20 kN/m^3 below it. The natural water content of clay was observed as 60%, and specific gravity is 2.65. Its liquid limit was 75%. Estimate the probable settlement if the ground level is raised by a 2 m thick fill of dense sand of density 19 kN/m^3. (10)

9 a) A cohesive soil yields a maximum dry density of 18kN/m3 at an optimum moisture content of 16% during a standard proctor test. If the value of G is 2.65, what is the degree of saturation? What is the maximum dry density it can be further compacted to? (10)

b) A 5 m deep cut is made in a soil having Cu=15 kN/m^2 and $\phi=10^o$, if the slope is 1:1 what is the factor of safety with respect to cohesion? If the slope is changed to 1:1.5 H, what will be the change in factor of safety with respect to cohesion? The unit weight of soil is 18 kN/m^3. The stability numbers for $\phi=10^o$ are as follows. (10)

Slope angle	45^o	30^o	15^o
Stability number	0.108	0.075	0.023

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CE208
Course Name: GEOTECHNICAL ENGINEERING I (CE)

Max. Marks: 100 Duration: 3 Hours

Graph sheets can be used.

PART A

Answer any two full questions. Each question carries 15 marks.

1 a) Define void ratio, porosity, water content and degree of saturation 5

b) Derive an equation to express the bulk density of a soil mass in terms of its void ratio, water content, specific gravity, degree of saturation and density of water 5

c) The bulk density and dry density of a partly saturated soil sample are 1.98 g/cc and 1.56 g/cc respectively. Determine the porosity, water content and degree of saturation of the soil. Given, G = 2.72 5

2 a) State Stoke's law. What are the limitations of Stoke's law. 5

b) The results of sieve analysis performed in a soil are given below. 10
The mass of dry sample taken for the test was 300g.Draw the particle size distribution curve and determine the uniformity coefficient and coefficient of curvature and comment on the result.

Sieve size	4.75mm	2.4mm	1.2mm	600µ	425 µ	300 µ	150 µ	75 µ
Mass of soil retained (g)	19.4	24.96mm	29.37	36.88	45.74	47.99	37.74	57.92

3 a) The bulk density and moisture content of a partly saturated soil sample are 1.79 g/cc and 18% respectively. The specific gravity of solids is 2.7.Determine the void ratio, degree of saturation and dry density 7

b) Draw the plasticity chart as per Indian Standards and classify the soil having the following values of Atterberg limitsLL = 41%, PL = 29%, SL = 17% 8

PART B

Answer any two full questions. Each question carries 15 marks.

4 a) State Darcy's law. Define coefficient of permeability of a soil from this law. 5

b) The subsoil at a site consists of 2m thick layer of clay, which is underlain by a deep sand layer. The ground water table is at 3m below GL. Unit weight of clay is 18kN/m^3, while that of sand above and below water table are 15.5 and 18.2 kN/m^3 respectively. Find out the total, neutral and effective stress at a depth of 5m below ground level. The unit weight of water may be taken as 10kN/m^3. 10

5 a) What is pole of a Mohr's circle? Explain with a sketch how it can be used to determine the stresses on any plane in a soil element subjected to external stresses. 7

b) If the major and minor principal stresses through a mass of soil at the instant of 8

failure are 6kPa and 2kPa respectively. Calculate the normal and shear stress on a plane making an angle of 30° with the direction of minor principal stress.

a) Derive an expression for the effective stress at a depth 'Z' in a soil mass when the direction of flow of water through the soil is (i) downward (ii) upward 7

6

b) In a falling head permeability test, the water level in the stand pipe dropped from 40 to 20cm in 1 hour. The diameter of the sample and stand pipe were 8cm and 0.5cm respectively, while the height of the sample was 9.5cm.Determine the coefficient of permeability of soil in m/day 8

PART C

Answer any two full questions. Each question carries 20 marks

7 a) Define compression index. How can it be determined from a consolidation test? 5

b) Distinguish between normally consolidated soil, under consolidated soil and an over consolidated soil. 5

c) A 2m clay stratum is overlain by a 3.5m thick sand stratum and underlain by a rock. The saturated densities of sand and clay are 1850 and 1980 kg/m^3respectively.The ground water table is at the ground level. It has been estimated that the vertical stress intensity at the middle of the clay layer is likely to increase by 50% due to the construction of a structure. Estimate the compression of the clay stratum. 10

Given coefficient of volume change = 0.023 cm^2/kg.

8 a) Explain the friction circle method of determination of the factor of safety of a given slope with respect to a given slip circle. 10

b) The optimum moisture content and maximum dry density of a soil obtained from the standard Proctor's tests are 18% and 1.67g/cc. If the sp. Gravity of soil solids is 2.7, determine the degree of saturation of the soil at OMC and the dry density corresponding to a zero air voids condition at OMC 10

9 a) Explain the procedure for determination of coefficient of consolidation by square root of time fitting method. 10

b) Derive an expression for factor of safety against sliding in a cohesionless soil. 5

c) What do you understand by light compaction and heavy compaction? Under what circumstances are light and heavy compaction tests are carried out in the laboratory? 5

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: CE208

Course Name: GEOTECHNICAL ENGINEERING I (CE)

Max. Marks: 100 Duration: 3 Hours

(Graph sheets - ordinary as well as semi-log - may be supplied on request)

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) Void ratio of a soil decreases from 1.15 to 0.85 upon densification. What is the corresponding percentage decrease in volume? 6

b) A soil sample is compacted to a bulk unit weight of 18kN/m^3 at 10% water content. Find the void ratio and degree of saturation of the soil. Also find the weight of water to be added to 100 m^3 of this soil for complete saturation. Assume G=2.75 9

2 a) A clay has a liquid limit of 52% and shrinkage limit of 17%. If a specimen of this soil shrinks from a volume of 10000mm^3 at liquid limit to 6010 mm^3 at shrinkage limit determine the specific gravity of soil grains. 6

b) Draw I.S. Plasticity chart and mark the details. What is its practical application? 9

3 a) Starting from the fundamentals, derive an expression for bulk unit weight in terms of air content, water content and percentage air voids. 8

b) Why is a deflocculating agent correction needed for observed hydrometer reading? What is the nature of correction [positive or negative]? Mention a commonly used deflocculating agent. 7

PART B

Answer any two full questions, each carries 15 marks

4 a) Differentiate between critical hydraulic gradient and exit gradient. 6

b) A sand deposit has: void ratio=0.85; G=2.7. WT is at 1.5m depth below GS and the soil above WT is also fully saturated due to capillarity. Determine the total, neutral and effective stress at 1.2m and 4.2m beneath the GS. 9

5 a) Minor and major principal stresses at failure for a sample of soil subjected to triaxial test are 150kPa and 536.6kPa respectively. Determine the angle of internal friction of this soil, if its cohesion is 25kPa. Also determine (i) the angle made by the failure plane with the horizontal; and (ii) direction of maximum 15

shear stress.

6 a) State any 4 merits of triaxial test over direct shear test. 6

b) A permeameter of 80mm diameter contains a 2-layered soil sample of length 300mm (200mm thick soil having $k=4\times10^{-6}$ mm/sec. underlain by 100mm thick soil with $k=4\times10^{-7}$ mm/sec.) If a falling head permeability test is conducted on this soil with a standpipe of diameter 15mm., what would be the time taken the time taken for the head to fall from 500mm to 100mm? 9

PART C

Answer any two full questions, each carries 20 marks

7 a) The following observations were recorded in a consolidation test on a fully saturated sample. Initial height of sample= 20mm; diameter of sample=60mm; 20

Applied pressure (kPa)	0	25	50	100	200	400	800
Height of soil sample (mm)	20	17.5	17.1	16.5	15	13.5	12.0

Dry weight of soil sample=76.34gms.; G=2.7; Draw e-log p graph and estimate compression index.

8 a) An embankment is constructed at dry density-OMC condition ($20kN/m^3$ and 9%). Borrow area soil has: G=2.5. Determine degree of saturation and percentage air voids of the compacted soil. Also determine the theoretical maximum dry density to which the sample can be compacted. Assume density of water $=10kN/m^3$. 14

b) What is meant by factor of safety with respect to cohesion. When does it become equal to factor of safety with respect to shear strength? 6

9 a) How can the pre-consolidation pressure on clay be estimated? 10

b) What are the forces considered in friction circle method of slope analysis? Suggest any 4 methods for improving the stability of a slope. 10

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: CE208

Course Name: GEOTECHNICAL ENGINEERING I

Max. Marks: 100 Duration: 3 Hours

(Graph sheets may be supplied on request)

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) Define void ratio, porosity, air content and percentage of air voids. 5

b) An embankment having total volume of 2500 m^3 is to be constructed having bulk density of 1.98 gm/cm^3 and placement water content of 18%. The soil is to be obtained from either borrow area A or borrow area B which has void ratio of 0.78 and 0.69 respectively. The water contents of these areas 16% and 12% respectively. If the cost of excavation is Rs. $36/m^3$ from each area. The cost of transportation is Rs.33 and Rs.37 per m^3 from borrow area A and borrow area B respectively. Which area is more economical? Take specific gravity of soils as 2.66. 10

2 a) With the help of particle size distribution graph, define the following (i) Well graded soil (ii) poorly graded soil (iii) gap graded soil 5

b) The wet weight of the soil specimen having size 40 mm diameter and 80 mm height is 1.6N. Its weight after 24 hrs of oven drying is 1.4N. Determine the water content, dry unit weight, bulk unit weight, void ratio and degree of saturation. The specific gravity of soil can be taken as 2.7. 10

3 a) Sketch the plasticity chart used for classifying a fine-grained soil. Classify the soil as per IS classification system 7

Percentage of soil finer than 75-micron sieve = 14%

Percentage of soil finer than 4.75 mm sieve = 63%

Liquid limit = 28%

Plasticity index = 12%

b) An air-dried soil sample weighting 500 gm was sieved in the laboratory. The results are given below. Draw the grain size distribution curve and find the uniformity coefficient, coefficient of curvature, effective size, percentage of gravel and percentage of sand. 8

IS sieve (mm)	4.75	2.0	1.0	0.425	0.212	0.15	0.075	pan
Mass retained (gm)	10	165	100	85	40	30	50	20

PART B

Answer any two full questions, each carries 15 marks

4	a)	Determine the ratio of average coefficient of permeability in the horizontal to vertical direction for a deposit consists of three layers 6m, 1.5m and 3m and having coefficient of permeability $2.5X10^{-2}$ mm/s, $3.5X10^{-5}$ mm/s, $4.5X10^{-2}$ mm/s. Assume the layer to be isotropic.	7
	b)	A direct shear test was conducted on sand gave a failure shear stress of 70 kN/m^2 when the normal stress was 200 kN/m^2. Draw the mohr circle, mohr failure envelope and find the angle of shear resistance. Find the principal stresses at failure and orientation principal planes.	8
5	a)	State and explain Darcy' s law.	4
	b)	In a variable head permeability test the initial head is 50 cm. The head drops by 15cm in 15 minutes. Find the time required to run the test for the final head to become 20 cm. Take the height and cross sectional area of the soil sample as 6 cm and 50 cm^2 respectively. Take the area of stand pipe as 0.5 cm^2.	5
	c)	An unconfined compression test was conducted on clay sample 150 mm diameter and 300 mm height. The failure load was 150N and axial deformation at the time of failure was 3 mm. Find the cohesive strength of the soil.	6
6	a)	Write the merits and demerits of direct shear test	6
	b)	A soil profile consists of surface layer of gravel 4 m thickness having density 17 kN/m^3, an intermediate layer of clay 3.5m thickness having saturated density 18 kN/m^3 and bottom layer of sand 4 m thickness having saturated density of 19 kN/m^3. The water table is at 4m from ground level. Determine the total stress, neutral stress and effective stress at bottom and interface layers.	9

PART C

Answer any two full questions, each carries 20 marks

7	a)	Define normally consolidated soil, over consolidated soil and under consolidated soil.	5
	b)	Write down the weight of hammer, height of fall, number of layers, volume of the mould and number of blows per layer for I.S.Light compaction test.	7.5
	c)	At a site the soil consists of sand up to 3.5m depth and from 3.5m to 7m the soil is normally consolidated clay. The water table is at 1.5m from ground level. The density of sand is 19 kN/m^3 above the water table and 20 kN/m^3 below the water table. The natural water content and specific gravity of clay are 60% and 2.65 respectively. The liquid limit of clay is 75%. Estimate the probable settlement of clay layer, if the pressure at mid-height of clay layer increases by 40kPa.	7.5
8	a)	Explain the method to find the preconsolidation pressure.	6
	b)	Explain the procedure for determination of coefficient of consolidation by logarithm of time fitting method.	6

	c)	An undisturbed sample of clay 20mm thickness consolidated 50% in 25 minutes in the laboratory when drainage allowed at top and bottom. The same clay having thickness 5m exist in the filed with sandy layer at top and bottom of clay. Find the time required to consolidate 50% and 90% in the field.	8
9	a)	Find the factor of safety with respect to cohesion of clay laid at a slope of 1 in 2 for a height of 12m. The angle of friction and cohesive strength are respectively 10^0 and 30 kN/m^2. Take the density of soil as 20 kN/m^3. The stability number for the given condition is 0.064.	5
	b)	Explain Swedish circle method	7
	c)	The maximum dry density of a soil sample obtained from light compaction test is 1.85 g/cc and optimum moisture content is 14%. If the specific gravity of solids is 2.65, determine the degree of saturation of soil at OMC and the dry density corresponding to zero air void condition at OMC.	8

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

Course Code: CE208

Course Name: GEOTECHNICAL ENGINEERING I (CE)

Max. Marks: 100 Duration: 3 Hours

(Assume suitable data whereever necessary. Graph sheets may be supplied on request)

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) Explain with a neat sketch the three phase diagram for soil. Define air content and percentage air voids with the help of phase diagram. 5

b) Derive from the first principle the expression $\gamma_b=((G+Se)\gamma_w)/(1+e)$. 6

c) Calculate the void ratio and dry density of the soil sample with 25% prorosity if the specific gravity is 2.75. 4

2 a) The insitu density of soil is 16kN/m^3. The weight of soil filled in a one litre container in its loosest state and densest state are 15N and 17N respectively. What is the density index of the soil? G =2.67 4

b) The plastic limit and plasticity index of the soil are 13% and 10 respectively. If the natural water content of the soil is 18%. Determine the following. 5

a) Liquid Limit b)Liquidity Index c) Consistency Index

c) Define uniformity coefficient and coefficient of curvature and its importance. 6

3 a) A partially saturated sample from a borrow pit has a natural water content of 14% and bulk unit weight of 19kN/m^3. The specific gravity of solids is 2.70. Determine the void ratio and degree of saturation. What will be the unit weight of the sample on saturation? 8

b) Define Stoke's law and its limitations. 4

c) Classify the soil with justifications; Cu=7, Cc=2, % Gravel =20%, % Sand =75%. 3

PART B

Answer any two full questions, each carries 15 marks

4 a) Define i)Effective stress ii) Quick Sand Condition iii)Phreatic Line 5

b) A 8m thick soil profile consists of 5m depth sand layer above a 3m depth clay layer. The water table is at 3m below the ground level. The sand above water 10

table is 40% saturated. The void ratio of sand layer is 0.6 with a specific gravity of 2.65. The clay layer has a water content of 45% with a specific gravity of 2.70. Draw the Total, neutral and effective stress diagram up to a depth of 8m. Neglect capillary flow.

5 a) What are the advantages of triaxial test over direct shear test? 4

b) A vane 108mm long and 72mm in diameter was pressed into a soft clay at the bottom of the bore hole. Torque was applied and its value at failure was 45N.m. Find the shear strength of the clay on the horizontal plane. If the top of the vane is flush with the surface of the soft clay, find the torque that is required to be applied for failure 5

c) In a drained triaxial test on a dense sand the cell pressure was 150kPa and the deviator stress to cause failure was 540kPa. Calculate the angle of internal friction. Also find the angle made by the failure plane with respect to the major principal plane. 6

6 a) A sample in a variable head permeameter is 100mm in diameter and 120mm high. The permeability of the sample estimated to be 10^{-3}mm/s. If it is desired that the head in the stand pipe should fall from 250mm to 100mm in 180s, determine the size of the stand pipe to be used. 4

b) The following results were obtained when a loose silty sand was tested in a direct shear test. 7

Normal stress (kN/m^2)	125	235	345
Maximum Shearing Stress (kN/m^2)	95	160	237

Determine:

a) the shear strength parameters for the soil

b) the magnitude of principal stresses and the orientation of principal planes.

c) Write the laboratory tests to determine the shear strength parameters of soil. 4

PART C

Answer any two full questions, each carries 20 marks

7 a) What are the assmptons in Terzaghi's one dimensional consolidation theory 5

b) In a laboratory consolidometer test on a 20mm thick sample of saturated clay taken from a site, 50% of the consolidation was reached in 10minutes. Estimate the time required for the clay layer of 5m thickness at the site for 50% compression if the bottom is impervious. Assume that the laboratory sample and the clay sample at the site are both subject to the same increase in stress. How 9

much time will take the clay layer to reach 90% consolidation? What is the time required for the clay layer to reach 50% consolidation if the clay has double drainage? (represent the time in years)

c) Define i) primary consolidation settlement ii) secondary consolidation settlement iii) Degree of consolidation. 6

8 a) Define i) Relative compaction ii) zero air void line iii) optimum moisture content 6

b) A cohesive soil yields a MDD of 1.8g/cc at an OMC of 16% during standard proctor test. If the value of G is 2.65, What is the degree of saturation? What is the maximum dry density to which it can be further compacted to? 6

c) Explain the friction circle method of analysis of stability of earth slopes 8

9 a) What is coefficient of consolidation of soil? How will you evaluate it with square root time method? 7

b) A cutting is to be made in clay for which the cohesion is $35kN/m^2$ and $\Phi=0$. The density of soil is $20kN/m^3$. Find the maximum depth for a cutting of side slope 1.5 to 1, if the factor of safety is to be 1.5. Take Taylor's stability number for a 1.5 to 1 slope for $\Phi=0$ as 0.17. 3

c) A certain clay layer has a thickness of 5m. After one year when the clay was 50% consolidated 8cm of settlement had occurred. For a similar clay and loading conditions how much settlement would occur at the end of one year and 4 years, if the thickness of this new layer is 25m? 10

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