University of Mumbai

Examination 2021 under cluster __ (Lead College: _____)

Examinations Commencing from 1 June 2021

Program: **BE Civil Engineering**

Curriculum Scheme: Rev 2016

Examination: TE Semester VI

Course Code: CEC601 and Course Name: Geotechnical Engineering-II

Time: 2 hour Max. Marks: 80

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Choose the most appropriate statement. During a consolidation test, at 50% average degree of consolidation, the effective stress is
Option A:	zero
Option B:	equal to total stress
Option C:	less than total stress
Option D:	equal to excess pore water pressure
2.	Choose the wrong statement.
Option A:	Consolidation test on a soil is a stress controlled test.
Option B:	Consolidation occurs due to dissipation of excess pore water pressure.
Option C:	During consolidation, void ratio of the soil decreases.
Option D:	During consolidation, degree of saturation decreases.
3.	A clay layer 4 m thick is sandwiched between two sand layers and subjected to some vertical pressure from the superstructure built over it. Co-efficient of consolidation was found to be 0.025 cm^2/min. Calculate the time required for 50% consolidation.
Option A:	around 10 months
Option B:	around 12 months
Option C:	around 7 months
Option D:	around 5 months
4.	In a UU triaxial test on pure clay sample, confining pressure was 50 kN/m^2, deviator stress at failure was 110 kN/m^2 and pore water pressure measured at failure was 30 kN/m^2. Calculate the effective major principal stress at failure.
Option A:	60 kN/m^2
Option B:	130 kN/m^2
Option C:	100 kN/m^2
Option D:	80 kN/m^2
5.	The concept of shear strength is not required directly to analyse the problems related to which one of the following?
Option A:	flow through the soil mass
Option B:	bearing capacity of foundations
Option C:	stability of earth slopes
Option D:	lateral earth pressure from soils on retaining structures

6.	A saturated clay sample was subjected to CD triaxial test. Cell pressure = 50 kN/m^2. Major principal stress at failure = 150 kN/m^2. At failure, estimate the normal stress on an inclined plane making an angle of 30 degree with the major principal plane inside the soil sample.
Option A:	55 kN/m^2
Option B:	110 kN/m^2
Option C:	75 kN/m^2
Option D:	125 kN/m^2
7.	The backfill behind a retaining wall consists of cohesionless soil having $\phi = 30°$ and unit weight of 19 kN/m^3. The backfill surface is horizontal. If the wall is pushed towards the backfill, calculate applying Rankine's concept the inclination of possible failure plane with horizontal is?
Option A:	30°
Option B:	60°
Option C:	45°
Option D:	15°
8.	A vertical smooth retaining wall is supporting 8 m height backfill of cohesionless sand with an angle of internal friction of 30° and dry unit weight of 18 kN/m^3. The water table rises to the backfill surface. Saturated unit weight of the backfill is 22 kN/m^3. Estimate the total active earth pressure force (rounded to the nearest integer) acting on the wall.
Option A:	444 kN/m
Option B:	524 kN/m
Option C:	555 kN/m
Option D:	424 kN/m
9.	From Culmann's graphical method, the active earth pressure force is determine by measuring from the tangent point on Culmann's line
Option A:	the normal distance to ϕ-line
Option B:	the distance to ϕ-line parallel to ψ-line
Option C:	the normal distance to ψ-line
Option D:	the distance to ψ -line parallel to ϕ-line
10.	A square footing 2.5 m by 2.5 m is built in a homogeneous bed of sand of unit weight 20 kN/m^3 and having an angle of shearing resistance of 36°. The depth of the base of footing is 1.5 m below the ground surface. Nc = 65.4, Nq = 49.4, $N\gamma$ = 54.0. Calculate the safe load that can be carried by a footing with a factor of safety of 3 considering general shear failure. Use Terzaghi's analysis.
Option A:	5462.5 kN
Option B:	5800.5 kN
Option C:	6250 kN
Option D:	5200 kN
11.	When the water table rises to the ground surface, the ultimate bearing capacity of a shallow foundation on sand is reduced about
Option A:	50%
Option B:	75%
Option C:	25%

Option D:	0%
12.	The permissible settlement is the maximum in the case of
Option A:	Isolated footing on clay
Option B:	Raft on clay
Option C:	Isolated footing on sand
Option D:	Raft on sand
13.	The equation given by Skempton for compression index for a remoulded sample is
Option A:	$C_c=0.009(w_L-10\%)$
Option B:	$C_c=0.007(w_L-10\%)$
Option C:	$C_c=0.007(w_L-20\%)$
Option D:	$C_c=0.007(w_L-30\%)$
14.	A long natural slope of cohesionless soil is inclined at 12° to the horizontal. What will be the factor of safety of the slope if $\varphi = 30°$?
Option A:	0.13
Option B:	0.4
Option C:	2.72
Option D:	0.4
15.	Failure of the stability of slopes, generally occurs along
Option A:	Slip plane
Option B:	A curved surface
Option C:	A horizontal surface
Option D:	All the surfaces
16.	If the failure occurs along a surface of sliding that intersect the slope at its toe, the slide is known as
Option A:	Base failure
Option B:	Face failure
Option C:	Slope failure
Option D:	Combined failure
17.	If a hammer is raised by steam and allowed to fall by gravity on top of the pile, it is called as
Option A:	Single acting hammer
Option B:	Vibratory hammer
Option C:	Diesel hammer
Option D:	Drop hammer
18.	The piles that are used for protecting structures from ships and floating object is
Option A:	Anchor piles
Option B:	Compaction piles
Option C:	Fender piles
Option D:	Batter piles
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Option A:	Compaction piles

Option B:	Anchor piles
Option C:	Fender piles
Option D:	Batter piles
20.	If the angle of internal friction decreases, then K_a
Option A:	decreases
Option B:	increases
Option C:	equal to zero
Option D:	does not change

Q2 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Explain spring analogy theory for primary consolidation.
ii.	Classify shear tests depending upon drainage condition and how these are simulated to field conditions.
iii.	What are different types of slope failures? Explain briefly finite and infinite slopes.
B	**Solve any One** **10 marks each**
i.	A saturated soil stratum 6m thick lies above an impervious stratum and below a previous stratum. It has a compression index 0.28 and a coefficient of permeability of 3.5×10^{-4} cm/sec. Its void ratio at a stress of 150kPa is 1.95. Determine (i) the change in void ratio due to an increase in stress to 210kPa; (ii) settlement of the soil stratum due to the above increase in stress; and (iii) time required for 50% consolidation. Assume, time factor (T) for 50% consolidation as 0.20.
ii.	The following data relate to a triaxial compression test performed on a soil sample. i) determine the total and effective stress parameter of the soil. ii) draw failure envelope from Mohr circles.

Test No	Cell Pressure (kPa)	Max. Deviator Stress (kPa)	Pore Pressure at Max. Deviator Stress (kPa)
1	80	175	45
2	150	240	50
3	210	300	60

Q3 (20 Marks)	
A	**Solve any Two** **5 marks each**
i.	Compare Rankine's theory of lateral earth pressure to coulomb's theory of lateral earth pressure.
ii.	Mention different types of shallow foundation and briefly explain with neat sketch.
iii.	Classify and briefly explain different types of pile foundation based on load

	transfer, function and method of construction.
B	**Solve any One** **10 marks each**
i.	A smooth rigid retaining wall of 6m high carries a uniform surcharge load of 12kPa. The backfill is clayey sand possessing the following properties: Υ=16kN/m^3, ϕ=25^o, and c = 6.5kPa. Determine the passive earth pressure and draw the pressure diagram.
ii.	A footing 2m square is laid at a depth of 1.3m below the ground surface. Determine the net ultimate bearing capacity of sand using I.S. code method. Take Υ=20kN/m^3 and ϕ=30^o. With continuation of above parameters determine the net ultimate bearing capacity of the footing if: (i) the water table rises to the level of the base, and (ii) the water table is 1m below the base.