



# MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.



## MUST KNOW CONCEPTS

MKC

CIVIL

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Course Code & Course Name : 19CEC08 & Geotechnical Engineering

Year/Sem/Sec : II/IV/-

S.No.	Term	Notation (Symbol)	Concept / Definition / Meaning / Units / Equation / Expression	Units
<b>Unit-I : Soil Classification and Compaction</b>				
1.	Soil Mechanics	-	Application of the laws and principles of mechanics dealing with soil	-
2.	Water Content	w	weight of water to the weight of solids	%
3.	Density of Soil	-	Mass the soil per unit volume	g/m <sup>3</sup>
4.	Bulk Density	$\rho$	Total mass of the soil per unit of its total volume	g/m <sup>3</sup>
5.	Dry Density	$\rho_d$	mass of soils per unit of total volume of the soil	g/m <sup>3</sup>
6.	Saturated Density	$\rho_{sat}$	When the soil mass is saturated, the bulk density is called saturated density	g/m <sup>3</sup>
7.	Submerged Density	$\rho'$	Submerged mass of the soil solids per total volume	g/m <sup>3</sup>
8.	Unit Weight of Soil Mass	-	Weight per unit volume	KN/ m <sup>3</sup>
9.	Bulk Unit Weight	$\gamma$	Total weight of a soil mass per total volume	KN/ m <sup>3</sup>
10.	Dry Unit Weight	$\gamma_d$	Weight of solids per total volume of the soil mass	KN/ m <sup>3</sup>
11.	Unit Weight of Solids	$\gamma_s$	Weight of soil solids per unit volume of solids	KN/ m <sup>3</sup>
12.	Submerged Unit Weight	$\gamma'$	Submerged weight of soil solids per total volume of soils	KN/ m <sup>3</sup>
13.	Saturated Unit Weight	$\gamma_{sat}$	Total weight of a saturated soil sample to its total sample	KN/ m <sup>3</sup>

14.	Void Ratio	$e$	Volume of soil solids in the given soil mass	-
15.	Porosity	$n$	Volume of voids to the total volume of soil mass	-
16.	Degree of saturation	$S_r$	volume of water present in a given soil mass to the total volume of voids on it	-
17.	Percentage of air voids	$n_a$	Volume of air voids to the total volume of soil mass	-
18.	Air content	$a_c$	Volume of air void to the volume of voids	-
19.	Density Index	$I_D$	Differences between the voids ratio of the soil in the loosest state and densest states.	%
20.	Compaction	-	The soil particles are artificially rearranged and packed together into a closer strata	-
21.	Aim of the compaction	-	Increase the shear strength and stability, Reduce the compressibility and permeability of the soil	-
22.	Methods available for sieve analysis	-	Dry sieve Analysis, Wet sieve analysis	-
23.	Atterberg limits	-	The limit at which the soil, changes from one state to another state	-
24.	Liquid limit	-	Is the water content at which the soil, changes from liquid to plastic state liquid	-
25.	Plastic limit	-	The maximum water content at which, soil changes from plastic to semi-solid state	-

### Unit-II : Soil Water and Permeability

26.	Three Major Atterberg limits	-	Liquid Limit, Plastic Limit, Shrinkage Limit	-
27.	Limitations of sedimentation analysis	-	The soil particles are not spherical and Stokes' law is applicable only when the liquid is infinite	-
28.	Soil classification	-	Classification based on grain size, Textural, AASHTO and Undefined	-

			classification	
29.	Consolidation	-	Process of reduction of volume under sustained, static loading.	-
30.	Factors Affecting Compaction	-	Water content, Amount of compaction, Type of soil, Method of compaction, Admixture	-
31.	Methods of Compaction	-	Tampers and Rollers	-
32.	Soil water	-	Water present in the voids of a soil mass	-
33.	Types of soil water.	-	Free water, Held water, Structural water, Absorbed water, Capillary water	-
34.	Free water	-	Water that is free to move through a soil mass under the influence of gravity	-
35.	Held water	-	Water is not free to move under gravitational forces	-
36.	Structural water	-	The water chemically combined in the crystal structure of the soil mineral	-
37.	Adsorbed water	-	The soil particles freely adsorb water from atmosphere by the physical forces of attraction	-
38.	Capillary water	-	Water held in the interstices of soil due to capillary forces	-
39.	capillary action (or) capillarity	-	The movement of water in the interstices of a soil due to capillary forces	-
40.	Contact moisture	-	Water can also be held by surface tension round the point of contact of two particles	-
41.	Permeability	-	The passage of water (or) other fluids through its interconnecting voids	-
42.	laminar flow	-	Each fluid particle travels along a definite path which never crosses the path of any other particle	-
43.	Turbulent flow	-	The paths are irregular, twisting and Random	-
44.	Importance's for the study of	-	Determination of rate of settlement, Calculation of seepage and uplift	-

	seepage of water		pressure	
45.	Darcy's law	-	The rate of flow or the discharge per unit time is proportional to the hydraulic gradient	-
46.	Coefficient of permeability	-	The average velocity of flow to the total cross-sectional area	cm/sec
47.	Seepage velocity	-	The rate of discharge of percolating water per unit cross-sectional area of voids	-
48.	Factors affecting permeability	-	Grain size, Properties of the pore fluid, Voids ratio of the soil, Adsorbed water in clayey soils	-
49.	Methods to determine the permeability coefficient	-	Laboratory methods, Field methods, Indirect methods	-
50.	Capillary Siphoning	-	The capillary forces will pull the water in descending part of the earth dam, and will slowly empty it	-
<b>Unit-III : Effective Stress Distribution due to Applied Loads and Settlement</b>				
51.	Surface Tension	-	surface film of water tending to contract the contained volume	-
52.	Capillary Rise	-	A rise in a liquid above the level of zero pressure	-
53.	Stream Lines or Flow Lines	-	The path along which the individual particles of water seep through the soil	-
54.	Properties of flow nets	-	Flow lines and equipotential lines meet at $90^\circ$ to one another, Fields are approximately squares	-
55.	Applications of flow net	-	Determination of seepage, Hydrostatic pressure, Seepage pressure and exit gradient	-
56.	Assumption in Boussinquin's equations	-	Soil is homogenous, Isotropic and semi infinite	-
57.	Pressure Distribution Types	-	Stress isobar, Vertical pressure distribution on a horizontal and vertical	-

			line.	
58.	Iso-Bar	-	It is a curve, connecting all points below the ground surface of equal vertical pressure	-
59.	Pressure bulb	-	Loaded soil mass bounded by an isobar of given vertical pressure. intensity	-
60.	Contact Pressure	-	Vertical pressure acting at the surface of contact between the base of footing and the underlying soil	-
61.	Compressibility	-	Decrease in the volume of soil mass under stress	-
62.	Co-efficient of Compressibility	$a_v$	Decrease in voids per unit increase of pressure	-
63.	Volume Change	$m_v$	Change in volume of a soil mass per unit of initial volume due to a given increase in the pressure	-
64.	Assumption in Terzaghi's theory	-	Soil is homogenous and fully saturated, Soil particles and water are incompressible	-
65.	Shear strength	-	The material or component fails in shear	-
66.	Tests for determine the shear strength	-	Direct shear test, Tri axial Shear test, Unconfined compression test, Vane shear test	-
67.	Advantages of direct shear test	-	Little control on the drainage of soil, plane of shear failure is pre determined	-
68.	Advantages of tri axial tests	-	Drainage conditions can be performed with complete control, Uniform Stress distribution	-
69.	Pore pressure parameters	-	The response of pore pressure due change in the total stress under un-drained condition	-
70.	Skempton's pore pressure equation		$\Delta u = B (\Delta \sigma_3 + A(\Delta \sigma_1 - \Delta \sigma_3))$	-
71.	Limitations of direct shear test	-	The Mohr circle cannot be drawn, Stress distribution on the failure is not uniform	-

72.	Normally consolidated soil	-	Pressure greater than the present existing pressure	-
73.	Over consolidated soil	-	The past to a pressure in excess of the present pressure	-
74.	Components of shearing resistance	-	Structural resistance, Frictional resistance and Cohesion or adhesion	-
75.	Principal plane	-	The plane at which there is zero shear stress	-
<b>Unit-IV : Shear Strength</b>				
76.	Principal stress	-	The maximum normal stress a body can have at its some point	-
77.	Strength equation	s	$s = c + \sigma \tan \phi$	N/mm <sup>2</sup>
78.	Under consolidated soil	-	A deposit that is not fully consolidated under the existing overburden pressure.	-
79.	Use of Vane shear test	-	Used to determine the undrained shear strength of cohesive soil	-
80.	Components of vane shear test	-	Four thin steel plates, Welded orthogonally to a steel rod and calibrated torsion spring	-
81.	Depth factor	D <sub>f</sub>	The ratio between total depth (H + D) to the depth (H) is called depth factor.	-
82.	Methods for analysis of finite slope	-	Cullman's method, Swedish slip circle method, Friction circle method and Bishop's method	-
83.	Types of slip surface in a finite slope	-	Planer failure surface, Circular failure surface and Non-circular failure surface	-
84.	Critical surface failure	-	The surface along which the soil mass slides when the failure of an earth slope occurs	-
85.	Causes of slope failure	-	Rainfall, Erosion, Steady seepage, Sudden drawdown, Earthquake and external loadings, etc.,	-
86.	Factor of safety	F	The ratio between actual strength of the	-

			soil to the mobilized strength	
87.	Critical depth	$H_c$	If the depth is greater than the slope can be stable only upto a limited depth	-
88.	Critical conditions for stability analysis	-	During steady seepage, Sudden drawdown and Immediately after construction	-
89.	Land slide	-	Downward or outward movement of portion of the soil is the case of natural slope	-
90.	Stability number	$s_n$	Taylor represents the result using a theoretical number, which is called the Stability number	-
91.	Slide	-	The failure of a mass of soil located beneath a slope	-
92.	Assumptions in the analysis of slope	-	Stress is two dimensional and Coulomb's theory can be used to compute the shear strength	-
93.	Planer failure	-	The failure occur in a soil deposite with a specific plane of weakness	-
94.	Forces acting in circular failure	-	Weight of the sliding wedge, Cohesive force and Reaction developed along the slip surface	-
95.	Thixotropy	-	Remoulded soil is allowed to rest without change in water content	-
96.	Types of shear tests based on drainage	-	Drained test, Undrained or quick test and Consolidated undrained test	-
97.	Sensitivity	--	Saturated clays are remoulded without change in water content they lose part of their shear strength	-
98.	Degree of sensitivity	-	The ratio of undisturbed shear strength to the remoulded shear strength under undrained conditions	-
99.	Types of slopes	-	Finite slope and Infinite slope	-
100.	Finite slope	-	Slopes extending to infinity do not exist in nature	-

### Unit-V : Slope Stability

101.	Examples of finite slope	-	Earth dam, Embankment and Cuts, etc.,	-
102.	Tension crack	-	A tension crack may develop, when the inclination angle of the slip surface is steep	-
103.	Slope protecting methods	-	Brush layering, Stabilization, Retaining walls, Seeding and planting	-
104.	Principle behind Newmark's chart	-	each area unit causes the equal vertical stress at the centre of the diagram	-
105.	Factors affecting compression behaviour of soils	-	Permeability, Method of compression, Compressibility and Water content	-
106.	Influence diagram	-	A diagram is plotted for unit load ( $Q = 1$ )	-
107.	Process of consolidation	-	A decrease in the water content of a saturated soil without replacement of the water by air	-
108.	Applications of pressure bulb	-	Used to indicate the maximum shear stress distribution at a point under a strip load and circular loaded area	-
109.	Secondary consolidation	-	The excess pore pressure is dissipated, the change in voids ratio continues, but generally at a reduced rate	-
110.	Components of settlement	-	Immediate, Primary consolidation and Secondary compression settlement	-
111.	Uses of consolidation test	-	To determine the Voids ratio, Co-efficient of volume change and Co-efficient of permeability	-
112.	Compression index	-	The modulus of the slope of the virgin compression curve	-
113.	Stress Isobar or pressure bulb	-	The zone in a loaded soil mass bounded by an isobar of given vertical pressure intensity	-
114.	Stages of consolidation	-	Initial consolidation, Primary consolidation, Secondary consolidation	-
115.	Specific surface	-	The total surface area of the soil in a unit	-



			mass	
116.	Activity of clays	-	The ratio of plasticity index to the percent by weight of soil particles	-
117.	Quick clay	-	Clay having sensitivity greater than 16	-
118.	Collapsible soils	-	The soil having decrease in volume due to increase in moisture even without increase in external loads	-
119.	Residual soil	-	It is formed due to Mechanical or Chemical weathering of rock	-
120.	Transported soil	-	It is formed due to Gravity, Ice, Water and Wind	-
121.	Effective size of a particle	$D_{10}$	The size corresponding to 10 percent on the grain size	-
122.	Compaction curve	-	A curve showing the relationship between dry density ( $y$ -axis) and water content ( $x$ -axis)	-
123.	Soil shrinkage ratio	-	Ratio of a given volume change to the corresponding change in water content above the shrinkage limit	-
124.	Saturated mass density	-	The ratio between total soil mass of saturated sample to its total volume.	-
125.	Plasticity	-	which allows it to be deformed rapidly, without rupture, without elastic rebound	-

#### Placement Questions

S.No	Term	Notation ( Symbol)	Concept/Definition/Meaning/Equation/ Expression	Units
126.	Formula for Speed	s	Distance / Time	m/sec
127.	Formula for Time	t	Distance / Speed	sec
128.	Formula for Distance	d	Speed x Time	m
129.	Area of triangle	A	(Base × Height) / 2	m <sup>2</sup>
130.	What is the area of a triangle with base	A	25	m <sup>2</sup>

	5 meters and height 10 meters?			
131.	Specific Gravity of water	G	1	-
132.	Density of aggregate	$\rho$	1200-1750	kg/m <sup>3</sup>
133.	Density of Concrete (R.C.C)	$\rho$	2500	kg/m <sup>3</sup>
134.	Density of Concrete (P.C.C)	$\rho$	2400	kg/m <sup>3</sup>
135.	The density of steel is in the range of	$\rho$	7750 and 8050	kg/m <sup>3</sup>
136.	Bulk Unit Weight of a dense wet soils	$\gamma$	18	KN/ m <sup>3</sup>
137.	Bulk Unit Weight of a loose dry soils	$\gamma$	11	KN/ m <sup>3</sup>
138.	Average the specific gravity of cement is	-	3.15	-
139.	The particle density of Portland cement ranges from	-	3.10 to 3.25	Mg/m <sup>3</sup>
140.	Vane tester is normally used for determining in situ shear strength of	-	soft clays	-
141.	Consolidation in soils is a function of	-	Pore water pressure	-
142.	The slope of the $e$ -log $p$ curve for a soil mass gives	-	Compression Index	-
143.	Principle involved in the relationship between	-	Archimedes' principle	-

	submerged unit weight and saturated weight of a soil is based on			
144.	Lysimeter and Tensiometer are used to measure	-	Evapotranspiration and capillary potential	-
145.	Group symbols assigned to silty sand and clayey sand are respectively	-	SM and SC	-
146.	When the water content of soil lies between its liquid limit and plastic limit, the soil is said to be	-	Plastic State	-
147.	The clay mineral, whose structural units are held together by potassium bond is	-	Illite	-
148.	Number of layers in the light compaction test	-	3	-
149.	Height of fall in the light compaction test	h	310	mm
150.	Mass of rammer in the light compaction test	m	2.6	kg

**Faculty Team Prepared**

**Signature**

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**HoD**