Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2150609 **Date: 10/05/2017**

Subject Name: Soil Mechanics

Time: 02:30 PM to 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **Answer the following** **14**

1 **The unit weight of soil at zero air voids depends on**

A	Specific gravity	C	Water content
B	Unit weight of water	D	All of these

2 **Compaction by vibratory roller is the best method of compaction in case of**

A	Moist silty sand	C	Clay of medium compressibility
B	Well graded dry sand	D	Silt of high compressibility

3 **The vertical stress at depth z directly below the point load P is (k is constant)**

A	$k*(P/z)$	C	$k*(P/z^2)$
B	$k*(P/z^3)$	D	$k*(P/\sqrt{z})$

4 **A 25 kN point load act on the surface of an infinite elastic medium. The vertical pressure intensity in kN/m²at a point 6.0 m below and 4.0 m away from the load will be**

A	132	C	13.2
B	1.32	D	0.132

5 **A direct shear test was conducted on a cohesionless soil (c=0) specimen under a normal stress of 200 kN/m². the specimen failed at a shear stress of 100 kN/m². the angle of internal friction of this soil is**

A	26.6°	C	30.0°
B	29.5°	D	32.6°

6 **For a sample of dry cohesionless soil with friction angle, Φ, the failure plane will be inclined to the major principal plane by an angle equal to**

A	Φ	C	45°
B	45°- Φ/2	D	45° + Φ/2

7 **Vane tester is normally used for determining in situ shear strength of**

A	Soft clay	C	Stiff clay
B	sand	D	Gravel

8 **The earth pressure for the design of bridge abutments is taken as**

A	Active thrust	C	Thrust in at rest condition
B	Passive thrust	D	None of the above

9 **Coulomb's theory of earth pressure is based on**

A	The theory of elasticity	C	Empirical rules
B	The theory of plasticity	D	Wedge theory

10 A deep cut of 7 m has to be made in a clay with unit weight of 16 kN/m^3 and a cohesion of 25 kN/m^2. What will be the factor of safety is one has to have a slope angle 30°? Stability number is given to be 0.178(from Taylor's chart) for a depth factor of 3.

A	0.8	C	1.25
B	1.1	D	1.0

11 In friction circle method of slope analysis, if r defines the radius of the slip circle, the radius of friction circle is

A	r sinΦ	C	r cosΦ
B	r	D	r tanΦ

12 A footing 2m x 1m exerts a uniform pressure of 150 kN/m^2 on the soil. Assuming a load dispersion of 2 vertical to 1 horizontal, the average vertical stress (kN/m^2) at 1.0 m below the footing is

A	50	C	80
B	75	D	100

13 The measure of soil compaction is its wet density. (True/False)

14 A foundation is considered as shallow if its depth is

A	less than 1 meter	C	equal to or less than its width
B	greater than its width	D	greater than 1 meter

Q.2 (a) In a standard proctor test 1.8 kg of moist soil was filling the mould (volume=944 cc) after compaction. A soil sample weighting 23 g was taken from the mould and ovendried for 24 hours at a temperature of 110°C. Weight if the dry sample was found to be 20 g. specific gravity of soil solids is G=2.7. Find out theoretical maximum value of the dry unit weight of the soil at that water content. 03

(b) Enlist and explain factors affecting compaction. 04

(c) A concentrated load of 40 kN acts on the surface of a soil. Determine the vertical stress increment at points directly beneath the load upto a depth of 10m with an interval of 1 m and draw a plot. 07

OR

(c) Plot the variation of vertical stress increment due to load on horizontal planes at depths of 1 m, 2 m and 3 m upto a horizontal distance of 3 m for 1 m interval on either side of centre. 07

Q.3 (a) Write limitations of shear box tests. 03

(b) Enlist and explain shear tests bases on drainage condition. 04

(c) Explain triaxial test. 07

OR

Q.3 (a) For a triaxial shear test conducted on a sand specimen at a confining pressure of 100 kN/m^2 under drained condition, resulted in deviator stress (σ_1-σ_3) at failure of 100 kN/m^2. Find the angle of shearing resistance. 03

(b) Following results were obtained from an undrained shear box test on a soil 04

Normal load (N)	250	500	750
Failure load (N)	320	460	610

Determine the strength parameters in terms of total stresses. The c/s area of shear box was 36 cm^2.

(c) Explain direct shear box test. 07

Q.4 (a) An unsupported excavation is made to the maximum possible depth in a clay soil having γ_t=18 kN/m^3, c = 100 kN/m^2, Φ=30°. Find out active earth pressure, according to Rankine's theory, at the base level of the exaction. 03

(b) Write about Initial, primary and secondary consolidation. 04

(c) Derive equation for total force due to earth pressure at rest. 07

OR

Q.4 (a) A retaining wall of height 8 m retains dry sand. In the initial state, the soil is loose and has a void ratio of 0.5, γ_d = 17.8kN/m^3 and Φ = 30°. Subsequently, the backfill is compacted to a state where void ratio is 0.4, γ_d = 18.8kN/m^3 and Φ = 35°. Find out the ratio of passive thrust to the final passive thrust, according to Rankine's earth pressure theory. 03

(b) Determine the active pressure on the retaining wall shown in Fig. 1. 04

(c) A clay layer whose total settlement under a given loading is expected to be 12 cm settles 3 cm at the end of 1 month after the application of load increment. How many months will be required to reach a settlement of 6 cm? How much settlement will occur in 10 months? Assume the layer to have double drainage. (For T_v = 0.492 U=76%) 07

Q.5 (a) Differentiate between shallow and deep foundation. 03

(b) In a laboratory, the consolidation test was performed on a specimen of clay 3 m thick. The sample was drained at top and bottom. The time required for 50% consolidation of the sample was observed to be 15 minutes. Determine the coefficient of consolidation of clay. 04

(c) A cutting of depth of 10 m is to be made in soil which has c=30 kN/m^2, γ=19kN/m^3 and Φ=0. There is a hard stratum below the original soil surface at a depth of 12 m. Find the safe slope of cutting if factor of safety is 1.5for D_f=1.2. (S_n=0.143 for i=30° and S_n=0.101 for i=15°) 07

OR

Q.5 (a) Enlist different types of foundations. 03

(b) A long natural slope in an overconsolidated clay (c'=10 kN/m^2, Φ'=25° and γ_{sat}=20 kN/m^3) is inclined at 10° to the horizontal. The water table is at the surface and the seepage is parallel to slope. If a plane slip had developed at a depth of 5 m below the surface, determine the factor of safety. Take γ_w=10kN/m^3. 04

(c) Enlist and explain types of slope failures. 07

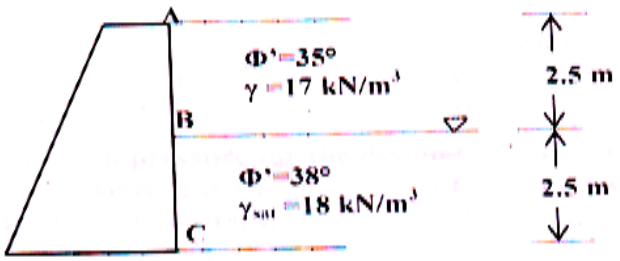

FIG-1