

Soil Stabilization and Exploration

Q.1 Consider the following statements:

To obtain an undisturbed soil sample from bore hole in soft soils, the conditions to be satisfied are

1. a rotary sampler is to be used.
2. a piston sampler should be used.
3. the inside clearance should be less than 3%.
4. heavy wall sampler with brass liner should be used

Which of the above statements are correct?

- (a) 1 and 3 (b) 2 and 3
(c) 1 and 2 (d) 2, 3 and 4

Q.2 In context of soil sampling, following statements are made

1. If mineral content is modified but soil structures and water content remains unchanged, then it is called representative sample.
2. Representative sample can be used to determine particle size distribution, consistency limit and specific gravity.

(With reference to above statements, which of the following holds good?)

- (a) Both statement are true
(b) Statement 2 is true but 1 is false
(c) Statement 1 is false but 2 is true
(d) Both statements are false

Q.3 Consider the following statements:

1. The soil obtained from wash boring is a representative sample.
2. Recovery ratio will be high during drilling in sound rock.
3. Hollow stem augers are sometimes used to drill holes in silty sand.

Which of these statement/s is/are correct?

- (a) 1 only (b) 1 and 2
(c) 2 and 3 (d) 3 only

Q.4 During a sampling operation, the drive sampler is advanced 600 mm and the length of the sample recovered is 525 mm. What is the recovery ratio of the sample?

- (a) 0.125 (b) 0.140
(c) 0.875 (d) 0.143

Q.5 The correct sequence of the increasing order of the disturbance caused to soil samples obtained from chunk, piston, split spoon and remoulded sampler is,

- (a) piston sampler, chunk sampler, split spoon sampler, remoulded sampler
(b) chunk sampler, piston sampler, split spoon sampler, remoulded sampler
(c) piston sampler, chunk sampler, remoulded sampler, split spoon sampler
(d) chunk sampler, piston sampler, remoulded sampler, split spoon sampler

Q.6 Undisturbed soil samples are required for conducting

- (a) shrinkage limit
(b) specific gravity test
(c) consolidation test
(d) hydrometer test

Q.7 If a sampling tube has an inner diameter of 72 mm and an outer diameter of 75 mm, then the area ratio is

- (a) 0.0416 (b) 0.04
(c) 0.085 (d) 1

Q.8 Hydrated lime can be effectively used for stabilization of

- (a) sandy soils
(b) silty soils
(c) plastic clayey soil
(d) None of these

Q.9 In seismic exploration method, velocities V_1 and V_2 were 3000 m/s and 5000 m/s. The depth of overburden was 12.50 m. Based on these details, what is the distance corresponding to the break point of velocities?

- (a) 25 m (b) 40 m
(c) 50 m (d) 75 m

Q.10 Mechanical stabilization of weaker soils may be obtained by

- (a) compaction
(b) proper grading and mixing with suitable outside soils
(c) both (a) and (b)
(d) None of the above

Q.11 Hydrated lime $[\text{Ca}(\text{OH})_2]$ can effectively be used for stabilization of

- (a) sandy soils
(b) silty soils
(c) plastic clayey soils
(d) None of the above

Q.12 Stationary piston sampler and rotary sampler are

- (a) both thin walled samplers
(b) both thick walled samplers
(c) stationary piston sampler is a thin walled sampler and rotary sampler is a thick walled sampler
(d) stationary piston sampler is a thick walled sampler and rotary sampler is a thin walled sampler

Q.13 Which of the following statement is not correct?

- (a) The area ratio of a sampler should preferably be up to 10% and in no case exceed 15% to obtain good undisturbed samples.
(b) The inside clearance of a soil sampler helps in the elastic expansion of the soil sample after it enters the sampler tube from within the cutting edge; and hence the inner

diameter of the tube is kept higher than the inner diameter of the cutting edge by about 1 to 3%.

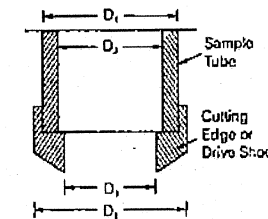
- (c) The outside clearance of a soil sampler is provided by keeping the outer dia of the cutting edge to be about 1 to 3% more than the outer dia of the sampler tube, to help in reducing the force required to withdraw the tube.

- (d) None of the above

Q.14 Undisturbed samples are obtained by

- (a) thin walled samplers
(b) thick walled samplers
(c) augers
(d) None of the above

Q.15 Figure relates to design features of samplers affecting soil disturbance. The area ratio of the soil sample is given by



- (a) $\frac{D_2^2 - D_3^2}{D_2^2}$ (b) $\frac{D_2^2 - D_1^2}{D_1^2}$
(c) $\frac{D_2^2 - D_4^2}{D_4^2}$ (d) $\frac{D_3^2 - D_1^2}{D_1^2}$

Q.16 Match List-I (Field test) with List-II (Useful for) and select the correct answer using the codes given below the lists:

List-I

- A. Vane shear test
B. Standard penetration test
C. Cyclic pile load test
D. Pressure meter test

List-II

- End bearing and skin friction resistance
- In-situ stress strain
- Soft clay
- Sandy deposits

Codes:

	A	B	C	D
(a)	4	2	1	3
(b)	3	4	1	2
(c)	4	3	2	1
(d)	3	4	2	1

- Q.17 Boring method is to be chosen depending upon the type of exploratory strata. In this context, match List-I with List-II and select the correct answer using the codes given below the lists:

List-I

- Auger boring
- Wash boring
- Percussion drilling
- Rotary drilling

List-II

- Partially saturated sands, silts and medium to stiff cohesive soils
- All types of soils and rocks except in stony or porous soils and fissured rocks
- Practically all types of soils except hard and cemented soil or rock
- All types of soils and rocks. Difficult in loose sands and soft sticky clays

Codes:

	A	B	C	D
(a)	1	4	3	2
(b)	1	3	4	2
(c)	2	4	3	1
(d)	2	3	4	1

- Q.18 Match List-I (Field test) with List-II (Parameters measured) and select the correct answer using the codes given below the lists:

List-I

- Plate load test
- Standard Penetration test
- Static Dutch Cone Penetration test
- Dynamic Penetration test

List-II

- Total and frictional resistances
- Load intensity and settlement values
- N_{60} Values
- SPT values

Codes:

	A	B	C	D
(a)	2	4	3	1
(b)	4	2	3	1
(c)	2	4	1	3
(d)	4	2	1	3

- Q.19 Consider the following statements:

- Dynamic cone penetration test for site investigation is based on the principle that elastic shock waves travel in different materials at different velocities.
- Electrical resistivity method of subsurface investigation is capable of detecting only the strata having different electrical resistivity.
- In-situ vane shear test is useful for determining the strength of very soft soil and sensitive clays and is unsuitable for sandy soil.

Which of these statements are correct?

- 1 and 2
- 1 and 3
- 2 and 3
- 2 alone

- Q.20 A soil sampler has following dimensions:

Inside diameter of cutting edge = 69 mm
Outside diameter of cutting edge = 73 mm
Inside diameter of sampling tube = 70 mm
Outside diameter of sampling tube = 72 mm
The outside clearance and area ratio of sampler are:

- 1.4493%, 1.3889%
- 1.3889%, 1.4493%
- 1.3889%, 11.9303%
- 1.4493%, 11.9303%

Answers Soil Stabilization and Exploration

- (d)
- (b)
- (c)
- (c)
- (a)
- (c)
- (c)
- (c)
- (c)
- (c)
- (c)
- (e)
- (d)
- (a)
- (b)
- (b)
- (c)
- (c)
- (c)

Explanations Soil Stabilization and Exploration

2. (b)
If soil structure, gets modified but mineral content and water content remains unchanged, then it is called representative sample.

3. (c)
Soil samples obtained from auger borings and wash borings are non-representative samples. Non-representative samples consist of mixture of materials from various soil or rock strata or are samples from which some mineral constituents have been lost or got mixed up.

4. (c)
Recovery ratio is defined as
$$R_r = \frac{\text{Actual length of sample in the tube}}{\text{Total length of the sampling tube driven below the bottom of the bore hole}}$$

$$R_r = \frac{525}{600} = 0.875 < 1$$

This indicates ($R_r < 1$) that the sample is compressed.

5. (a)
Piston sampler causes minimum disturbance and remoulded sampler tends to disturb the soil structure completely.

6. (c)
Undisturbed soil samples are used for determining soil structure based properties such as bulk unit weight, shear strength, permeability, compressibility through consolidation test etc. Soil grain based property can be found from disturbed representative samples.

7. (c)

$$\text{Area ratio} = \frac{D_0^2 - D_i^2}{D_i^2}$$

here, $D_0 = 75 \text{ mm}$ and $D_i = 72 \text{ mm}$

$$\therefore \text{Area ratio} = \frac{75^2 - 72^2}{72^2} = 0.085$$

9. (c)
The depth of the boundary between the two strata is given by

$$D = \frac{d}{2} \sqrt{\frac{V_2 - V_1}{V_2 + V_1}}$$

$$\Rightarrow 12.5 = \frac{d}{2} \sqrt{\frac{5000 - 3000}{5000 + 3000}}$$

$$\Rightarrow 12.5 = \frac{d}{2} \times \frac{1}{2}$$

$$\Rightarrow d = 12.5 \times 4 = 50 \text{ m}$$

14. (a)
Thin walled samplers are used for obtaining undisturbed samples. The area ratio is usually below 15%. Thin walled tubes are cold-drawn seamless tubes made out of brass, aluminium or any other suitable material having adequate strength durability and resistance to corrosion.

20. (c)
Outside clearance,

$$\% C_0 = \frac{D_2 - D_4}{D_4} \times 100 = \frac{73 - 72}{72} \times 100$$

$$= 1.3889\%$$

Area ratio,

$$\% A_R = \frac{A_2 - A_1}{A_1} \times 100 = \frac{\frac{\pi}{4} D_2^2 - \frac{\pi}{4} D_1^2}{\frac{\pi}{4} D_1^2} \times 100$$

$$= 11.9303\%$$