UNIT IV – SHEAR STRENGTH

Part A -2 Mark Questions & Answers

1. State the test to be conducted to find out the shear strength of a soil.
➢ Direct shear test
➢ Triaxial compression test
➢ Unconfined compression test
➢ Shear vane test

2. How can you divide the soil based on their shear strength?
➢ Cohesionless soil
➢ Purely cohesive soils
➢ Cohesive – fractional soils

3. Write a short note on shear.

In compression soils become gradually steer. In shear, however, soils become gradually softer, and if the shear stresses reach a certain level, with respect to the normal stresses, it is even possible that failure of the soil mass occurs. This means that the slope of sand heap, for instance in a depot or in a dam, can not be larger than about 30 or 40 degrees. The reason for this is that particles would slide over each other at greater slopes.

As a consequence of this phenomenon many countries in deltas of large rivers are very flat. It has also caused the failure of dams and embankments all over the world, sometimes with

Very serious consequences for the local population. Especially dangerous is that in very fine materials, such as clay, a steep slope is often possible for some time, due to capillary pressures

In the water, but after some time these capillary pressures may vanish (perhaps because of rain),

And the slope will fail. A positive application of the failure of soils in shear is the construction of

Guard rails along highways. After a collision by a vehicle the foundation of the guard rail will rotate in the soil due to the large shear stresses between this foundation and the soil body around it. This will dissipate large amounts of energy (into heat), creating a permanent deformation of the foundation of the rail, but the passengers, and the car, may be unharmed. Of course, the guard rail must be repaired after the collision, which can relatively easily be done with the aid of a tractor.

4. What is creep?

The deformations of a soil often depend upon time, even under a constant load. This is Called creep.

5. What is a principal plane?

At every point in a stressed body, there are three planes on which the shear stresses are zero. These planes are known as principal planes.

6. Define Mohr's circle.

It is a graphical method used for the determination of stresses on a plane inclined to the principal planes. The graphical construction is known as Mohr's circle.

7. State the merits of direct shear test.

➢ The sample preparation is easy. The test is simple and convenient.
➢ As the thickness of the sample is relatively small, the drainage is quick and the pore pressure dissipates very rapidly.
➢ It is ideally suited for conducting drained tests on cohesionless soils.
➢ The apparatus is relatively cheap.

8. State any four demerits of triaxial test

➢ The apparatus is elaborate, costly and bulky.
➢ The drained test takes a longer period as compared with that in a direct shear test.
➢ The strain conditions in the specimen are not uniform due to frictional restraint produced by the loading cap and the pedestal disc. This leads to the formation of the dead zones at each end of the specimens.
➢ The consolidation of the specimen in the test is isotropic, whereas in the field, the consolidation is generally anisotropic

9. Briefly explain unconfined compressive strength test.

The UCC test is a special form of a triaxial test in which the confining pressure is zero. The test can be conducted only on clayey soils which can stand without confinement. The test is generally performed on intact (non – fissured), saturated clay specimens. The test can be conducted in a triaxial test apparatus as s U – U test, it is more convenient to platform it in an unconfined compressive machine are as follows

➢ Machine with spring
➢ Machine with a proving ring

10. State the purpose of vane shear test

It is used to find the shear strength of a undrained soft clay.

11. Define stress path.

A stress path is a curve which shows the changes in stresses as the load acting on the soil specimen changes. Lambe's stress path is a commonly used stress path.

12. Give the types of stress path.

➢ Effective stress path
➢ Total stress path
➢ Total stress minus static pore pressure path

13. Define liquefaction of sand.

The phenomenon when the sand loses its shear strength due to oscillatory motion is known as liquefaction of sand. The structures resting on such soil sink. In the case of partial liquefaction the structure may undergo excessive settlement and the complete failure may not occur.

14. Give the factors affecting shear strength of cohesive soils.
- Structure of clay
- Clay content
- Drainage conditions
- Rate of strain
- Intermediate principle stress
- Repeated loading
- Confining pressure
- Plasticity index

Part B -12 Mark Questions

1. Write a detailed note on direct shear test.
2. Write a detailed note on Tri axial shear test.
3. What are the factors that influence the compaction of a soil mass?
4. What are all the factors that affect the permeability of a soil mass? Briefly Explain.
5. Explain with a neat sketch about vane shear test.
6. Explain UCC test.
7. Explain Mohr's stress circle for the shear strength of soil.
8. Explain in detail Mohr-Coulomb failure theory.