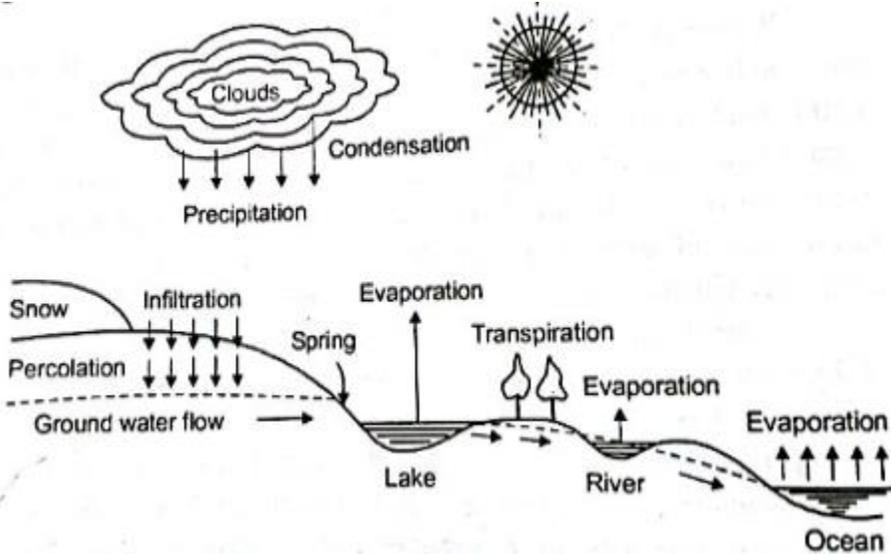


**BSEC – 2014**  
**Post: Assistant Engineer**

1. What is hydrological cycle? Describe it.

**Solution:**



The hydrologic cycle begins with the evaporation of water from the surface of the ocean. As moist air is lifted, it cools and water vapor condenses to form clouds. Moisture is transported around the globe until it returns to the surface as precipitation. Once the water reaches the ground, one of two processes may occur; some of the water may evaporate back into the atmosphere or the water may penetrate the surface and become groundwater. Groundwater either seeps its way to into the oceans, rivers, and streams, or is released back into the atmosphere through transpiration. The balance of water that remains on the earth's surface is runoff, which empties into lakes, rivers and streams and is carried back to the oceans, where the cycle begins again.

2. Short notes on SPT & bearing capacity of soil. If DL is 225 kips & LL is 185 kips on column, determine the footing size when bearing capacity of soil is 2 tsf.

**Solution:**

Total service load = DL + LL = 225 + 185 = 410 kip

Bearing capacity = 2 tsf = 4 ksf

Footing Area = Service load / Bearing capacity = 410/4 = 102.5 ft<sup>2</sup>

considering square footing =  $\sqrt{102.5} = 10.124 \text{ ft} \approx 10.5 \text{ ft}$

Footing size = 10.5 ft x 10.5 ft

### 3. What is cement? Difference between OPC & PPC. Why fly ash is added with cement?

#### **Solution:**

Cement is a binder, a substance used for construction that sets, hardens and adheres to other materials, binding them together. Cement is seldom used on its own, but rather to bind sand and gravel (aggregate) together. Cement is used with fine aggregate to produce mortar for masonry, or with sand and gravel aggregates to produce concrete.

Cement is a mixture of compounds consisting mainly of silicates and aluminates of calcium formed out of silica, calcium oxide, aluminum oxide and iron oxide.

PPC Cement: Pozzolana is a natural or artificial material which contains silica in the reactive form. Portland Pozzolana Cement is cement manufactured by combining Pozzolanic materials. This cement comprises of OPC clinker, gypsum and pozzolanic materials in certain proportions. The Pozzolanic materials include fly ash, volcanic ash, calcined clay or silica fumes. These materials are added within a range of 15% to 35% by cement weight.

OPC Cement: Ordinary Portland Cement (OPC) is manufactured by grinding a mixture of limestone and other raw materials like argillaceous, calcareous, gypsum to a powder. This cement is available in three types of grades, such as OPC 33 grade, OPC 43 grade and OPC 53 grade. OPC is the most commonly used cement in the world. This type of cement is preferred where fast pace of construction is done. However, the making of OPC has reduced to a great extent as blended cement like PPC has advantages, such as lower environmental pollution, energy consumption and more economical.

OPC	PPC
It has higher strength than PPC in the initial stage.	The strength of PPC is good than OPC in long terms.
It has high heat of hydration making it unfavorable for mass concreting.	The hydration process is slower than OPC resulting low heat of hydration. Therefore, it is suitable for mass concreting.
The presence of sulphates, alkalies, chlorides, etc. is higher and less resistant than PPC	It has low percentage of sulphate alkalis, chlorides, magnesia and free lime in its composition, which makes the concrete durable.
OPC is not favorable in aggressive weather.	Show greater resistance to aggressive weather.
OPC cement are available in three grades, such as 33 Grade, 43 Grade, 53 Grade	PPC is available in any specific grades.
It is slightly costlier than PPC.	Cheaper than OPC.

The use of fly ash in Portland cement concrete (PCC) has many benefits and improves concrete performance in both the fresh and hardened state. Fly ash use in concrete improves the workability of plastic concrete, and the strength and durability of hardened concrete. Fly ash use is also cost effective. When fly ash is added to concrete, the amount of Portland cement may be reduced.

Benefits to Fresh Concrete:

- Improved workability
- Decreased water demand
- Reduce heat of hydration

Benefits to Hardened Concrete:

- Increased ultimate strength
- Reduce permeability
- Improved durability

4. Standard size of brick? Write short note on three field tests of bricks.

**Solution:**

Standard size of brick = 9.5" x 4.5" x 2.75"

It is necessary to check the quality of brick before using it in any construction activities. There are some field tests that we can conduct in the field in order to check the quality of bricks. These tests are as follows.

- **Water Absorption:** When a brick is immersed in water for a period of 24 hours it should not absorb water more than twenty percent of its dry weight.
- **Visual inspection:** In this test bricks are closely inspected for its shape. The bricks of good quality should be uniform in shape and should have truly rectangular shape with sharp edges.
- **Dimension:** A good brick should have rectangular plane surface and uniform in size. This check is made in the field by observation.
- **Hardness:** In this test, a scratch is made on brick surface with the help of a finger nail. If no impression is left on the surface, the brick is sufficiently hard.
- **Soundness:** Two bricks are taken, one in each hand, and they are struck with each other lightly. A brick of good quality should not break and a clear ringing sound should be produced.
- **Structure:** A brick is broken and its structure is examined. It should be homogeneous, compact and free from any defects such as holes, lumps, etc.

5. What is column? Write ACI code of column & ties.

**Solution:**

A column or pillar in architecture and structural engineering is a structural element that transmits, through compression, the weight of the structure above to other structural elements below. In other words, a column is a compression member.

- For axially as well as eccentrically loaded columns, the ACI Code sets the strength-reduction factors at  $\Phi = 0.65$  for tied columns and  $\Phi = 0.75$  for spirally reinforced columns.
- The minimum longitudinal steel percentage is 1%, and the maximum percentage is 8% of the gross area of the section.

- At least four bars are required for tied circular and rectangular members and six bars are needed for circular members enclosed by spirals.
- The minimum diameter of spirals is 3/8 in., and their clear spacing should not be more than 3 in. nor less than 1 in.
- Ties for columns must have a minimum diameter of 3/8 in. to enclose longitudinal bars of no. 10 size or smaller and a minimum diameter of 1/2 in. for larger bar diameters.
- Spacing of ties shall not exceed the smallest of 48 times the tie diameter, 16 times the longitudinal bar diameter, or the least dimension of the column.

6. What is BOD & COD? Explain.

**Solution:**

Biochemical oxygen demand (BOD) is the amount of dissolved oxygen needed by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period.

COD or Chemical Oxygen Demand is the total measurement of all chemicals in the water that can be oxidized.

7. What is concrete? Short note on fine aggregate & coarse aggregate.

**Solution:**

Concrete is a composite material, which is made from a mixture of cement, aggregate (sand or gravel), water and sometimes admixtures in required proportions. It is one of the most important and useful materials for construction work.

Those particles which almost entirely passing the 4.75 mm (No. 4) sieve, and predominantly retained on the 75 µm (No. 200) sieve are called fine aggregate. For increased workability and for economy as reflected by use of less cement, the fine aggregate should have a rounded shape. The purpose of the fine aggregate is to fill the voids in the coarse aggregate and to act as a workability agent.

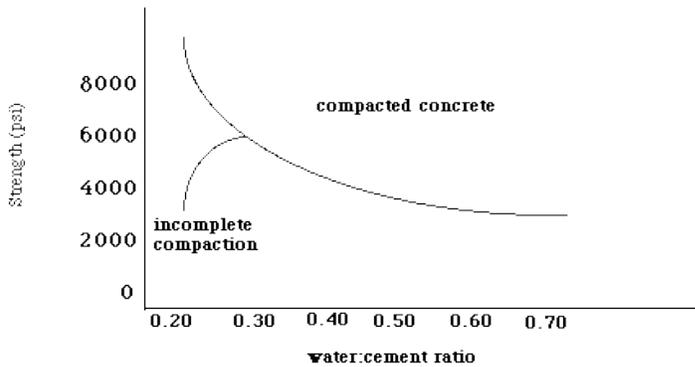
Those particles that are predominantly retained on the 4.75 mm (No. 4) sieve and will pass through 3-inch screen are called Coarse Aggregates coarse aggregate. The coarser the aggregate, the more economical the mix.

8. What is water cement ratio? How it affects concrete strength?

**Solution:**

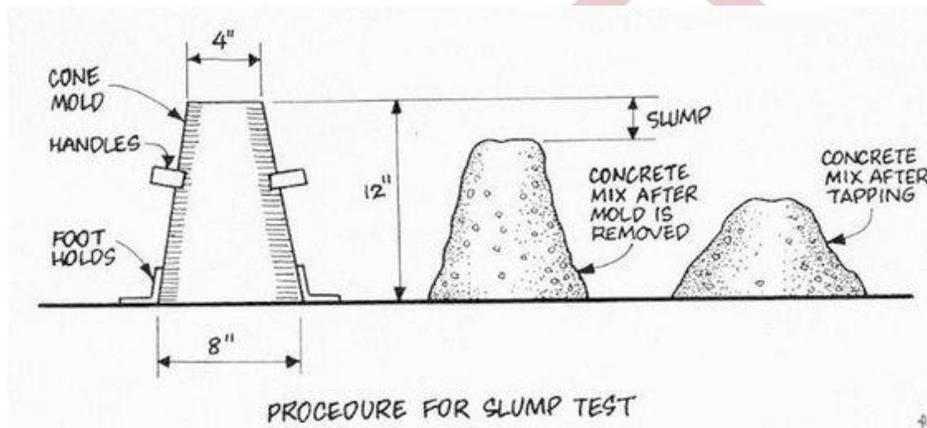
Water cement ratio can be defined as the ratio of the volume of water to the volume of cement used in a concrete mix. Water has a great role on the strength and workability of concrete. A lower ratio leads to higher strength and durability, but may make the mix difficult to work with and form. Work-ability can be resolved with the use of plasticizers or super-plasticizers. Too much water will result in segregation of the sand and aggregate components from the cement paste.

Also, water that is not consumed by the hydration reaction may leave concrete as it hardens, resulting in microscopic pores (bleeding) that will reduce final strength of concrete.



9. What is slump test? Describe.

**Solution:**



The concrete slump test is used for the measurement of a property of fresh concrete. The test is an empirical test that measures the workability of fresh concrete and used to determine the consistency of concrete. The test is popular due to the simplicity of apparatus used and simple procedure.

10. What is double reinforcement beam? Minimum clear cover slab, beam, column.

**Solution:**

The beam that is reinforced with steels both in tension and compression zone, it is known as doubly reinforced beam. This type of beam is mainly provided when the depth of the beam is restricted. If a beam with limited depth is reinforced on the tension side only it might not have sufficient resistance to oppose the bending moment. The moment of resistance cannot be increased by increasing the amount of steel in tension zone. Thus a doubly reinforced beam is provided to increase the moment of resistance of a beam having limited dimensions.

In most of the general cases the minimum values of clear cover are 75mm for Foundation, 40mm for Column, 40mm for Beam, 25mm for shear wall, 15mm for Slab and Stair.

11. Write down the fundamental principles of Bangladesh Constitution.

**Solution:**

The Constitution of the People's Republic of Bangladesh is the constitutional document of Bangladesh. It was adopted on 16 December 1972. It provides the framework of the Bangladeshi republic with a parliamentary government, fundamental human rights and freedoms, an independent judiciary, democratic local government and a national bureaucracy. The constitution includes references to socialism, Islam, secular democracy and the Bengali language. It commits Bangladesh to "contribute to international peace and co-operation in keeping with the progressive aspirations of mankind".

12. Describe briefly the proclamation of Independence 1971.

**Solution:**

The Proclamation of Independence was a fundamental instrument of law announced by Bengali nationalists during the Bangladesh Liberation War. The proclamation established the first government of Bangladesh and served as an interim constitution up till the adoption of the Constitution of Bangladesh, on 16 December 1972.

13. Short note on PWD, WASA, DESA, BRDB, BSTI.

**Solution:**

PWD: Public Works Department or PWD is a government department responsible for the construction of buildings and structures of government organization and agencies in Bangladesh and is located in Dhaka, Bangladesh. It is under the Ministry of Housing and Public Works.

WASA: Water Supply and Sewerage Authority or WASA is the main body administering Water supply, Drainage and Sanitation system in Bangladesh. It was established in the year 1963 as an independent organization

DESA: Dhaka Electric Supply Authority

BRDB: Bangladesh Rural Development Board or BRDB, is a government board responsible for the development in rural areas and is largest government program involved in rural development in Bangladesh and is located in Dhaka

BSTI: Bangladesh Standards and Testing Institution (BSTI) is a Government agency under the Ministry of Industries constituted for the purpose of controlling the standard of service and quality of the goods.

14. Tile size is 2ft x 2ft. 4ft wide walk way around a 200ft x 100ft tennis court. Calculate the no of tiles to cover the walk way.

**Solution:**

Length of walkway =  $200 + (100 - 2 \times 4) + 200 + (100 - 2 \times 4) = 584$  ft

Area of the walkway =  $4 \times 584 = 2336$  ft<sup>2</sup>

Area of one tile =  $2 \times 2 = 4$  ft<sup>2</sup>

Nos. of tile required = Area of the walkway / Area of one tile =  $2336 / 4 = 584$  Nos.

15. What is auto cad? Write down its application.

**Solution:**

CAD stands for "Computer Aided Design." AutoCAD is a line of two-dimensional and three-dimensional design software produced by the Autodesk Company. AutoCAD is a 2-D and 3-D computer-aided drafting software application used in architecture, construction, and manufacturing to assist in the preparation of blueprints and other engineering plans. Professionals who use AutoCAD are often referred to as drafters.

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