UNIT I

1. **List various types of cement. (MAY 2019)(NOV 2016)**

- Ordinary Portland cement
- High alumina cement
- Portland-Pozzolana cement
- Quick setting cement

2. **What is meant by hydration of cement? (MAY 2019)**

Cements used for making concrete have the property of reacting chemically with water in an exothermic process called hydration that results in water treatment products.

3. **What are Boque's compounds? (MAY 2018)(NOV 2019)**

- Tri calcium silicate 54.1%
- di calcium silicate 16.6%
- tri calcium aluminate10.8%
- tetra calcium aluminoferrite9.1%

4. **How do you classify aggregates based on size? (MAY 2018)**

- **Coarse aggregate:** Aggregates predominately retained on the No. 4 (4.75 mm) sieve. For mass concrete, the maximum size can be as large as 150 mm.
- **Fine aggregate (sand):** Aggregates passing No.4 (4.75 mm) sieve and predominately retained on the No. 200 (75 µm) sieve.
- Angular
- Rounded

5. **What are the various tests which are to be done on aggregates? (MAY 2017)**

Various test which are done on aggregates are listed below

- Sieve Analysis
- Water Absorption
- Aggregate Impact Value

- Aggregate Abrasion Value
- Aggregate Crushing Value

6. What are the advantages of sulphate resisting cement? (MAY 2017)

Sulphate resisting cement is used the following circumstances,

- Where the structures are subjected to be damaged by severe alkaline conditions.
- It is widely used in chemical industries.
- In sewage linings.
- In Marine Structures,
- In foundations and basements where soil contains sulphate.
- In pile fabrication, which are likely to be buried in marshy region or sulphate bearing soils.

7. What is meant by 53 grade cement? (NOV 2017)

Ordinary Portland **Cement** (OPC) is graded according to their strength. The **grade** indicates the compression strength (mpa) of the concrete that will attain after 28 days of setting. In the same fashion, **53 grade cement**refers to the compressive strength of that **cement** after 28 days in MPa or N/mm2.

8. .**What do you understand by grading of aggregates? (NOV 2017) (NOV 2019)**

- **Grading** refers to the determination of the particle-size distribution for **aggregate**. **Grading** limits and maximum **aggregate** size are specified because these properties affect the amount of **aggregate** used as well as cement and water requirements, workability, pumpability, and durability of concrete.
- **Grading of Aggregates** is one which is made up of stones of different sizes, ranging from large to small (inclusive of sand) so as to have minimum of air voids (and that will have maximum density) when mixed together

9. List the advantages of PPC (NOV 2016)

A pozzolan is a material which, when combined with calcium hydroxide (lime), exhibits cementitious properties. Pozzolans are commonly used as an addition (the technical term

is "cement extender") to Portland cement concrete mixtures to increase the long-term strength and other material properties of Portland cement concrete and in some cases reduce the material cost of concrete. Examples are:

Fly ash, Silica Fume,Rice Husk Ash and Metakaolin

10. Describe the importance of the quality of water used for concreting. (MAY 2016)(NOV 2018)

- Water is an important ingredient of concrete as itactively participates in the chemical reaction with cement.
- Since it helps to form the strength giving cement gel, the quantity and quality of water isrequired to be looked into very carefully.
- Since quality of water affects the strength, it is necessary for us to go into the purity and quality of water.

11. List the major composition of OPC. (MAY/JUNE 2016)

Lime (CaO)	**60 to 67%**
Silica (SiO2)	17 to 25%
Alumina (Al2O3)	3 to 8%
Iron oxide (Fe2O3)	0.5 to 6%

12. What is the importance of grade of cement?

- Grade of cement represents the 28 days compressive strength
- It is used for the structural purpose
- OPC33- 33MPa
- OPC43- 43 MPa
- OPC53- 53 Mpa

UNIT II

1. **What are plasticizers and super plasticiers? (MAY 2019)**

- Plasticizers are defined as chemical admixtures added to wet concrete mix to impart adequate workability properties
- Superplasticizers produce extreme workability and achieve reduction of water content without loss of water cement ratio i.e workability.

2. What are Accelerators? (MAY 2019)

- Accelerators reduce the setting time and generally produce early removal of forms and easily setting of concrete repair and path work. They are helpful in cold weather concreting.
- To permit earlier removal of formwork
- Reduce the required period of curing
- Advance the time that a structure can be placed in service
- In the emergency repair work Partially compensate for the
- retarding effect of low temperature during cold weather concreting

3. What are Air Entrained Admixtures? (MAY 2018)

- An addition for hydraulic cement or an admixture for concrete or mortar which causes air, usually in small quantity, to be incorporated in the form of minute bubbles in the concrete or mortar during mixing, usually to increase its workability and frost resistance. Air-entraining admixtures are surfactants that change the surface tension of the water.
- Air entrainment is used to produce a number of effects in both the plastic and the hardened concrete. These include:
    - Resistance to freeze – thaw action in the hardened concrete.
    - Increased cohesion, reducing the tendency to bleed and segregation in the plastic concrete.
    - Compaction of low workability mixes including semi - dry concrete.
    - Stability of extruded concrete.

- Cohesion and handling properties in bedding mortars.

4. **What are the properties of silica fume? (MAY 2018)**
   - Silica fume, also referred to as microsilica or condensed silica fume, is another material that is used as an artificial pozzolanic admixture. It is a product resulting from reduction of high purity quartz with coal in an electric arc furnace in the manufacture of silicon or ferrosilicon alloy
   - It is extremely fine with particle size less than 1 micron and with an average diameter of about 0.1 micron, about 100 times smaller than average cement particles. Silica fume has specific surface area of about 20,000 m^2/kg, as against 230 to 300 m^2/kg.

5. **What are the importance of water proofers in concrete?(MAY 2017)**
   - **Building regulations**. Local building codes strictly assert waterproofing as one of the important requirements in any high-rise building work.
   - **Risk prevention**. In preventive risk management of any structure, it is important to have the right waterproofing solutions to protect assets as well as its occupants. If not done correctly, it can result damage to the property, valuables and health risks to people.
   - **Prevent unnecessary cost**. It is wiser to invest in preventive risk measures than to pay for damage repairs. Any building requires regular maintenance to protect it from damage caused by water, roof waterproofing is an effective preventive measure.

6. **Define Metakaoline. (MAY 2017)**
   - **Metakaolin** is a dehydroxylated form of the clay mineral kaolinite. Stone that are rich in kaolinite are known as china clay or kaolin, traditionally used in the manufacture of porcelain.
   - The particle size of **metakaolin** is smaller than cement particles, but not as fine as silica fume.

7. What is pozzolanic action? (MAY 2016)

The pozzolanic reaction is the chemical reaction that occurs in portland cement upon the addition of pozzolans. The pozzolanic reaction converts a silica-rich precursor with no cementing properties, to a calcium silicate, with good cementing properties

8. **What are Super Plasticizers? (MAY 2016) (NOV 2016)**

- The use of superplasticizer is practiced for production of flowing, self levelling, self compacting and for the production of high strength and high performance concrete.

Merits:

Superplasticizers can produce:

- at the same w/c ratio much more workable concrete than the plain ones,
- for the same workability, it permits the use of lower w/c ratio,
- as a consequence of increased strength with lower w/c ratio, it also permits a reduction of cement content.

Demerits:

- superplasticizers are not showing the same extent of improvement in fluidity with all types of cements. Some superplasticizers may show higher fluidizing effect on some type of cement than other cement
- loss of workability due to rapid slump loss and incompatibility of cement and superplasticizers

9. list any four commercial available admixtures (NOV 2019)

- super plasticizer commix SP1030
- Plastcone HS200 super plasticizer
- Chemax Air entraining admixtures
- Pro spec Air entraining admixtures
- Sulphonated melamine formaldehyde condensates (SMF)
- Sulphonated naphthalene formaldehyde condensates (SNF)
- Polycarboxylate ether superplasticizers (PCE)

10. Difference between mineral and chemical admixtures. (NOV 2019)

- Chemical admixtures are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- while mineral admixtures are Inorganic materials that have pozzolanic or latent hydraulic properties, these very fine-grained materials are added to the concrete mix to improve the properties of concrete.

11. Name any two chemical admixtures and its significance. (NOV 2017)

- **Air entrainers**

  Air-entraining agents entrain small air bubbles in the concrete. The major benefit of this is enhanced durability in freeze-thaw cycles, especially relevant in cold climates.

- **Water reducers**

  Water reducing admixtures require less water to make a concrete of equal slump, or increase the slump of concrete at the same water content. Typical water reduction is the range of 10 – 15%

12. What are admixtures? (NOV 2017)

A material other than water, aggregates, or cement that is used as an ingredient of concrete or mortar to control setting and early hardening, workability, or to provide additional cementing properties.

13. List the factors affecting air entrainment.(NOV 2016)

- The type and quantity of air entraining agent used.
- Water/cement ratio of the mix.
- Type and grading of aggregate.
- Mixing time.
- The temperature.
- Type of cement.

- Influence of compaction.
- Admixtures other than air entraining agent used.

13. What are retarders? (NOV 2018)

Retarders increase the setting time of the concrete mix and reduce the water-cement ration. Usually up to 10% water reduction can be achieved. A wide range of water-reducing and set-retarding admixtures are used in ready mixes concrete.

UNIT III

1. **Define nominal and design mix. (MAY 2019)(MAY 2018)(MAY 2016)(NOV 2019)(NOV 2017)**

- Nominal mix is permitted by IS456:2000 for concrete of strength lower than M25
- Design mix is permitted by IS 10262-1982 and IS456:2000for concrete of strength Greater than M25 is design mix.
- **Nominal mix** is an art and **design mix** is a science. **Nominal mix** specifies the proportion of the cement , sand and aggregates without making special effort to know their individual properties. However , **design mix** is a process where in each and every ingredient of the concrete is first tested in the laboratory

2. **Define standard deviation and coefficient of variation (MAY 2019)**

- **Standard deviation** generally indicates the **deviation** of a set of variables from the mean value. ... For **concrete**, the target mean strength is calculated as the sum of characteristic strength of **concrete** and 1.65 times the **standard deviation** of the **sample**
- The **coefficient of variation** represents the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of **variation** from one data series to another, even if the **means** are drastically different from one another

3. **Give the reasons for variation in compressive strength of concrete of same mix (MAY 2018)**

    - Different compaction
    - Difference in curing
    - Human error
    - Equipment error

4. **List any four grades of cement concrete (MAY 2017)**
    - M10
    - M15
    - M20
    - M25
    - M30

5. **In which circumstances high grade concrete are used effectively? (MAY 2017)(NOV 2016)**
    - For high rise structures
    - Bridges
    - Dams
    - Prestressed structures

6. **What are the objectives of mix design? (MAY 2016)**
    - To ensure the most optimum proportions of the constituent materials to fulfill the requirement of the structure being built.
    - To achieve the designed/ desired workability in the plastic stage
    - To achieve minimum strength in hardened state
    - To achieve desired durability

7. **Calculate the cement and water content for M35 design mix as per IS specification (NOV 2018)**

    As per IS 10262 and IS 456, water content = 160 litres and cement =380 kg/m^3 with water cement ratio = 0.42

8. **What is the minimum grade of concrete used as per IS 456? (NOV 2017)**
    - It has been recommended that minimum grade of concrete shall be not less than M 20 in reinforced concrete work
    - The surface of the aggregate is dry and the internal pores may be partially filled with water. This condition may occur on a hot summer day or in an arid region.

The aggregates will likely absorb water from the mix, which may affect the workability of the concrete unless proper adjustments are made to the aggregate and water batch weights.

- The moisture content for each aggregate must also be calculated. Aggregate moisture contents will vary throughout a stockpile, with wetter aggregates located near the bottom of the pile. It is extremely important to calculate the aggregate moisture content at least once a day and perhaps more frequently when producing self-consolidating concrete (SCC), which is more sensitive to changes in aggregate moisture contents

9. What are the various methods of mix proportioning? (NOV 2018) (NOV 2016)

- Arbitrary proportion
- Fineness modulus method
- Maximum density method
- Surface area method
- Indian road congress, IRC 44 method
- High strength concrete mix design
- Mix design based on flexural strength
- ACI committee 211 method
- DOE method
- Indian standard recommended method IS 10262 – 82

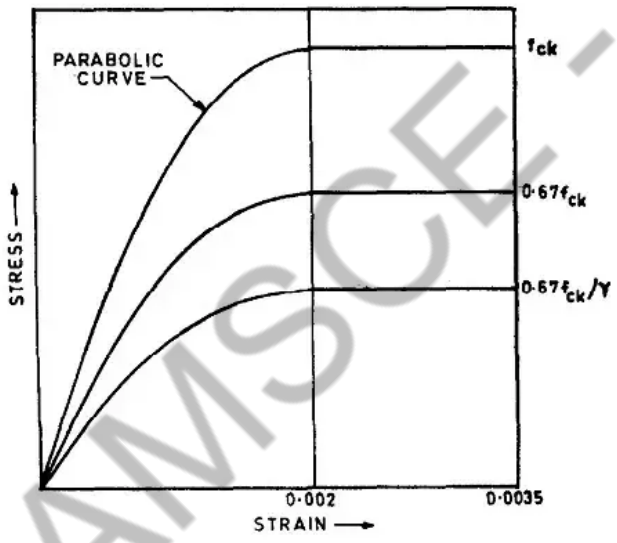
10. What are the testing methods for concrete? (NOV 2018)

- Slump test
- Compressive test
- Tension test
- Water permeability test
- Water absorption test

UNIT IV

1. **Give the importance of controlling workability (MAY 2019)**
    - It is the property of concrete which determines the amount of useful internal work necessary to produce full compaction
    - It governs the transportation, placing, compacting and finishing without segregation

2. **Draw the stress strain curve for concrete.(MAY 2019)**



3. **List the factors affecting workability of concrete. (MAY 2018) (NOV 2017)**
    - Water content
    - Mix proportions
    - Size of aggregates
    - Shape of aggregates
    - Surface texture of aggregates

- Grading of aggregates
- Use of admixtures.

4. Name the properties of hardened concrete (MAY 2018)

- Strength
- Creep
- Durability
- Shrinkage
- Modulus of Elasticity

5. List the advantages of ring tension test. (MAY 2017) (NOV 2016)

- The nature of the load application in this test is such that no clamping and misalignment stresses are introduced in the test specimen, a condition difficult to avoid in direct tests.
- The entire volume of the ring is subjected to tensile stresses with the uniformly distributed maximum stress occurring along the entire periphery of the ring. This is never achieved in the flexural tests and even in the cylinder splitting test a compressive load acting on a diametral plane creates a uniform tensile stress over that plane only.
- The magnitude of the radial compressive stress is quite small when compared with the tangential stress. This is a definite advantage over the splitting tension test in which the minimum compressive stresses occurring at the centre line of the splitting plane is about three times the corresponding tensile stress.

6. Define Bleeding.(MAY 2017) (NOV 2016)

- Bleeding is one form of segregation, where water comes out to the surface of the concrete, being lowest specific gravity among all the ingredient of concrete. Bleeding can be easily identified in the field by the appearance of a thin layer of water in the top surface of freshly mixed concrete.

- Bleeding is predominantly observed in a highly wet mix, badly proportioned and insufficiently mixed concrete. In thin members like roof slab or road slabs and when concrete is placed in sunny weather show excessive bleeding.

7. What are the effects of water cement ratio on strength and durability? (MAY 2016)

- A lower water-cement ratio leads to higher strength and durability, but may make the mix more difficult to place.
- As the W/C ratio increases, strength of concrete would reduce and so the durability properties. The W/C ratio can be lowered by utilizing water reducing admixtures such as plasticizers

8. **Why does concrete cylinder fails at lower stress than concrete cube? (MAY 2016)**

- Contact area of a standard cube mould with the upper platen in the testing machine is more which results in more confinement .
- more confinement resist against specimen expansion resulting in more compressive strength
- It's simply depends upon the platen restraint.

9. Define laitance. (NOV 2019)

Due to bleeding, water comes up and accumulates at the surface. Sometimes, along with this water, certain quantity of cement also comes to the surface. When the surface is worked up with the trowel and floats, the aggregate goes down and the cement and water come up to the top surface. This formation of cement paste at the surface is known as "Laitance".

10. Write the advantages of SIFCON. (NOV 2019)

- With this technique, macro-fibre contents up to about 20% by volume can be achieved, with a consequent enormous increase in both flexural load carrying capacity and toughness.

- With such high fibre volume, a very high compressive strength is also achieved. SIFCON can be used for blast resistant structures and burglar proof safe vaults in banks and residential buildings

11. What is fly ash concrete? (NOV 2018)

- Fly ash is a fine powder that is a byproduct of burning pulverized coal in electric generation power plants.
- Fly ash is a pozzolan, a substance containing aluminous and siliceous material that forms cement in the presence of water.
- When mixed with lime and water, fly ash forms a compound similar to Portland cement.

12. What are the importances of compaction of factor test conducted in concrete? (NOV 2018)

- Compaction factor test is the workability test for concrete conducted in laboratory.
- The compaction factor is the ratio of weights of partially compacted to fully compacted concrete.
- The compaction factor test is used for concrete which have low workability for which slump test is not suitable.

13. Mention the factors affecting strength of concrete. (NOV 2017)

- Concrete porosity
- Water/cement ratio
- Soundness of aggregate:
- Aggregate-paste bond
- Cement-related parameters

UNIT V

1. **State the merits of Ready mix concrete (MAY 2019)**
   - **Concrete** is produced under controlled conditions.
   - Placing and transportation is easy.
   - Dust pollution is reduced.
   - RMC uses bulk cement instead of bagged cement.
   - A high speed of construction.
   - Reduced noise and air pollution.
   - Environment pollution is reduced

2. **List the types of Polymer concrete (MAY 2019)**
   - Polymer Impregnated Concrete (PIC).
   - Polymer Cement Concrete (PCC).
   - Polymer Concrete (PC).
   - Partially Impregnated and surface coated polymer concrete.

3. **List the application of Heavy weight concrete (MAY 2018)**
   - Radiation shielding
   - Construction of ballasts for offshore pipelines
   - Protection of operational personnel against biological hazards

4. **Write a short note on Shortcrete. (MAY 2018)**

   A mixture of cement, sand, and water applied through a pressure hose, producing a dense hard layer of concrete used in building for lining tunnels and structural repairs.

5. **Enumerate SIFCON. (MAY 2017) (NOV 2016)**
   - **It is** Slurry infiltrated fibre concrete.
   - It is a relatively new special type of high performance (steel) fiber reinforced **concrete** (HPFRC). **Sifcon** is made by pre placing short discrete in the molds to its full capacity or to the desired volume fraction.

6. Write any two advantages of Geopolymer concrete (MAY 2017) (NOV 2016)

- Excellent mechanical properties
- Does not dissolve in acidic solutions
- Does not generate any deleterious alkali-aggregate reaction even in the presence of high alkalinity.
- Some applications of geopolymer concrete are for marine structures, precast concrete products such as railway sleepers, sewer pipes

7. Define high performance concrete. (NOV 2016)

High performance concrete" is used for concrete mixture which possess high workability, high strength, high modulus of elasticity, high density, high dimensional stability, low permeability and resistance to chemical attack.

8. What is polymer concrete and its merits (NOV 2016)

- **Polymer concrete** is a composite material in which the aggregate is bound together in a matrix with a **polymer** binder. The composites do not contain a hydrated cement phase, although portland cement can be used as an aggregate or filler.
- It has high impact resistance and high compressive strength.
- Polymer concrete is highly resistant to freezing and thawing.
- Highly resistant to chemical attack and abrasion.
- Permeability is lower than other conventional concrete.

9. Define durability of concrete (NOV 2019)

Durability of concrete may be defined as the ability of **concrete** to resist weathering action, chemical attack, and abrasion while maintaining its desired engineering properties

10. Write two advantages of light weight concrete (NOV 2018)

- Low density.

- Reduction of dead load
- Increases the progress of building
- Lowers haulage and handling costs
- Low thermal conductivity

11. What is principle in Geopolymer concrete (NOV 2018)

- Geopolymer is an inorganic alumino-silicate polymer, synthesized from predominantly silicon and aluminium material such as fly ash.
- Alkaline solutions are used, to induce the silicon and aluminium atoms in the source materials (fly ash), to dissolve to form gel.
- The polymerisation process may be assisted by applied heat followed by drying. The Geopolymer gel binds the loose coarse and fine aggregates to form geopolymer concrete.
- Geopolymer gel replace the C–S–H gel in cement concrete. Chemical reaction period is substantially fast and the required curing period may be within 24 to 48 hours.

12. What is light weight concrete (NOV 2017)

- **Lightweight concrete** can be **defined** as a type of **concrete** which includes an expanding agent in that it increases the volume of the mixture while giving additional qualities such as nailbility and lessened the dead weight.
- The main specialties of **lightweight concrete** are its low density and thermal conductivity.
- Density is 300 to 1850 kg/m^3

13. What is ferrocement (NOV 2017)

- Ferrocement is a system of construction using reinforced mortar or plaster lime or cement, sand and water applied over an armature of metal mesh, woven expanded-metal or metal-fibers and closely spaced thin steel rods such as rebar.