CE 6002 CONCRETE TECHNOLOGY

UNIT I

TWO MARK QUESTIONS

1. What is meant by Surkhi?

   Surkhi is fine powdered under burnt bricks. It is also known as artificial pozzolona

2. Define hydration of cement?

   Cement in dry state has no bonding property. When mixed with water react
   Chemically and becomes a bonding agent. These reactions are called hydration.

3. Define setting of cement

   When water is added to cement, hydration takes place immediately as it continuous, cement paste which is plastic becomes stiff and rigid known as setting of cement.

4. What are pozzolonas?

   These are siliceous materials which, while having no cementations values within
   themselves, will chemically react with calcium hydroxide at ordinary temperature and in thepresence of moisture to form compounds possessing cementitious properties.

5. Name any 2 natural pozzolonas.

   Clay and shales, opalinccherts, diatomaceous earth, volcanic tuffs and pumicites.

6. Name any 2 artificial pozzolonas.

   Surkhi, fly ash, blast furnace slag, silica fume, rice husk ash, metakaoline.

7. What is natural cement?

   Natural cement is manufactured by burningand then crushing the natural cement stones.Natural cement stones are such stones which contain 20 to 40% of argillaceous matter i.e. clay,and remaining content mainly calcareous matter which is either calcium carbonate alone or amixture of calcium carbonate and magnesium carbonate.

8. What is artificial cement?

   Artificial cement is manufactured by burning approximately proportioned mixture ofcalcareous and argillaceous materials at a very high temperature and then grinding the resultingburnt mixture to a fine powder.

9. What is the function of gypsum in the manufacture of cement?

   In order to delay the setting action of cement, when mixed with water, a little percentageof gypsum is added in the clinker before grinding them to fine powder.

10. What is known as clinker?

    Artificial cement is manufactured by burning approximately proportioned mixture ofcalcareous and argillaceous materials at a very high temperature and then grinding the resultingburnt mixture to a fine powder. The burnt mixture of calcareous and argillaceous matter isknown as clinker.

11. What are the constituents of ordinary cement?

    Alumina or clay, silica, lime, iron oxide, magnesia, sulphur trioxide, Alkalies, calciumsulphate (gypsum).

12. What are the harmful constituents of cement?

    Alkalies which are oxides of potassium and sodium, and magnesium oxide are theharmful constituents of cement.

13. What are ball mills?

Ball mills are used for grinding the clinkers. The ball mills consist of 2 to 2.5m diametersteel cylinder. The clinkers to be ground are fed into the cylinder and the cylinder is rotatedabout its horizontal axis to carry out the grinding action.

14. What are the types of cement?

Ordinary Portland cement, rapid hardening cement, low heat cement, blast furnace slagcement, sulphate resistant cement, air entraining cement, white and coloured cement, highalumina cement, pozzolanic cement, super sulphate cement, expansive cement, quick settingcement, water repellant cement, water proofing cement.

15. What are the 2 methods of manufacture of cement

Dry process

Wet process

16. Define mortar.

The mortar is a paste like substance prepared by adding required amount of water to a drymixture of sand or fine aggregate with some binding material like clay, lime or cement.

17. Define lime mortar.

If lime is used as a binding material, the resulting mortar is known as lime mortar.

18. Define mud mortar.

When clay is used as a binding material, the resulting mortar is known as mud mortar

19. What is known as bulking of sand?

Bulking of sand means increase in its volume. Fine aggregates or sands, increase involume when they possess some moisture. Bulking is due to formation of a thin film of wateraround the fine aggregate or sand particles. Thickness of water film goes on increasing withmore and more moisture and consequently increase in volume continues. But after certainpercentage of water, volume of sand starts decreasing with increasing amount of water.At certainpercentage of water, increase in volume completely vanishes and volume occupied by sandbecomes equal to the volume of dry sand.

20. What are the types of mortars?

Mud mortar

Lime mortar

Gauged mortar

21. What is meant by grading of aggregates?

Grading of aggregate means particle size distribution of the aggregate. If all the particleof an aggregate were of one size, more voids will be left on the aggregate mass. Properly gradedaggregate produces dense concrete and needs smaller quantities of fine aggregate and cement.Grading determines the workability of the mix, which controls segregation, bleeding,water-cement ratio, handling, placing, and other characteristics of the mix.

22. What are the methods of proportioning of concrete mixes?

Arbitrary standard method

Minimum voids method

Fineness Modulus method

Maximum density method

23. Define Abram's water cement law.

According to Abram's water cement law, the strength of concrete depends on the watercement ratio used.

24. Define bleeding.

The tendency of water to rise to the surface of freshly laid concrete is known as bleeding.

25. Define laitance.

Water rising to the surface during bleeding carries with it, particles of sand andcement, which on hardening form a scum layer known as laitance.

26. What are the steps adopted to control bleeding.
    - By adding more cement
    - By using more finely ground cement
    - By using little air entraining agent
    - By increasing finer part of fine aggregate
    - By properly designing the mix and using minimum quantity of water.

27. Define Segregation.

    The tendency of separation of coarse aggregate grains from the concrete mass is calledsegregation.

28. What are the methods adopted to avoid segregations of concrete.
    - Addition of little air entraining agents in the mix.
    - Restricting the amount of water to the smallest possible amount.
    - Concrete should not be allowed to fall from larger heights.

29. Define workability.

    Workability is that property of concrete which determines the amount of internal worknecessary to produce full compaction. It is a measure with which concrete can be handledfrom the mixer stage to its final fully compacted stage.

30. What are the factors affecting workability.

    Quantity of water in the mix
    - Proper grading of the aggregate mix
    - Ratio of fine aggregate and coarse aggregate
    - Maximum size of coarse aggregates
    - Method of compaction of concrete

31. What are the factors affecting proportioning of concrete mixes?
    - Water cement ratio
    - Cement content
    - Temperature
    - Age of concrete
    - Size, shape and grading of aggregate
    - Curing

32. Define mixing of concrete.

    The process of mixing cement, water, fine aggregate and coarse aggregate in suitableproportion is known as mixing of concrete.

33. What are the methods of consolidation or compaction of concrete?

    Hand compaction

    Machine compaction –

    i) Internal vibrators

    ii) Form vibrators

    iii) Surface vibrators

34. Define curing of concrete.

    Curing is the operation by which moist conditions are maintained on finished concretesurface, to promote continued hydration of cement.

35. What are admixtures?

    Admixtures are ingredients other than cement, fine aggregate and coarse aggregate toimprove the quality of concrete. The addition of an admixture may improve the concrete withrespect to its strength, hardness, workability, water resisting power etc.

36. Name the types of joints in concrete.

    1. Construction joints 2. Expansion joints
    3. Contraction joints 4. Working joints

37. What are the types of concrete used?

    Plum concrete, light weight concrete, air-entrained concrete, no-fines concrete, vaccumconcrete, water-proof concrete, reinforced cement concrete, pre-stressed concrete, cellular oraerated concrete, foamed concrete, pre-cast concrete.

38. Mention the test adopted to test the properties of cement in laboratories?
    a. Fineness
    b. Consistency test
    c. Setting time
    d. Soundness
    e. Compressive strength

39. Mention the test adopted to test the properties of cement in field?
    a. Open the bag and take a good look at the cement, there should not be any visible lumps
    b. Thrust your hand into the cement bag should feel cool feeling
    c. Take a pinch of cement and feel between the fingers. It should give a smooth feeling not a gritty feeling
    d. Take a hand full of cement and throw it on a bucket full of water, the particle should float for sometime before they sink.

40. Mention the test adopted to test the quality of water?
    a. Determination of acids and alkalis
    b. Determination of total solids.

16 MARKS

1. Explain in details the different tests employed for cement to ascertain its quality as per IS specification.
2. Explain with the help of a neat sketch, the wet process of manufacture of ordinary cement.
3. Explain with the help of a neat sketch, the dry process of manufacture of ordinary cement.
4. What do you understand by the term grading of aggregates. What importance this term carries as far as design of concrete mix is concerned.
5. Explain in details various stages of manufacturing of cement concrete.
6. Describe the importance of the quality of water used for concreting.
7. How does increasing the quality of water influence the properties of fresh and hardened concrete?
8. List the various tests conducted on coarse aggregate indicating the property being tested.
9. What is the effect of the maximum size of aggregate on concrete strength?
10. List the various types of cement indicating their use for different applications.
11. What are the important chemical tests conducted on cement to determine its quality?
12. What is soundness of cement and how is it tested?
13. Write explanatory notes on (a) uniform grading (b) gap grading (c) continuous grading.
14. What are the effects of the shape and texture of aggregates on the strength and workability of concrete?
15. What are the different moisture states in which aggregates exit?
16. Describe a test to determine the initial moisture content of fine aggregate in the construction site.

Describe the role played by gypsum in the hydration reaction of cement

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UNIT II – CHEMICAL AND MINERAL ADMIXTURES
TWO MARK QUESTIONS

1. What are admixtures?

Admixtures are ingredients other than cement, fine aggregate and coarse aggregate to improve the quality of concrete. The addition of an admixture may improve the concrete with respect to its strength, hardness, workability, water resisting power etc.

2. Why is admixture used?

Over decades, attempts have been made to obtain concrete with certain desired characteristics such as high compressive strength, high workability, and high performance and durability parameters to meet the requirement of complexity of modern structures.

The properties commonly modified are the heat of hydration, accelerate or retard setting time, workability, water reduction, dispersion and air-entrainment, impermeability and durability factors.

3. What are the types of Admixtures?
    1. Chemical admixtures
        - Accelerators,
        - Retarders
        - Water-reducing agents
        - Super plasticizers
        - Air entraining agents,etc.
    2. Mineral admixtures
        - Fly-ash Blast-furnace slag,
        - Silica fume
        - Rice husk Ash, etc

4. List the four main purposes of chemical admixtures using concrete?
    - Some chemical are mixed with concrete ingredients and spread throughout the body of concrete to favorably modify the moulding and setting properties of the concrete mix. Such chemical are generally known as chemical admixtures.
    - Some chemicals are applied on the surface of concrete to protect it during or after its setting.
    - Some chemicals are applied on the surface of mould used to form concrete to effect easy mould-releasing operation.
    - Some chemical are applied to bond or repair broken or chipped concrete.

5. What are plasticizers?

Plasticizers for concrete increase the workability of the wet mix, or reduce the water required to achieve the desired workability,

and are usually not intended to affect the properties of the final product after it hardens.

6. What are Accelerators?

   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.

7. What are retarders?

   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.

8. What is the purpose of adding admixture in concrete?

   - To improve the strength of concrete
   - To accelerate the initial setting of concrete
   - To retard the initial set
   - To improve workability
   - To inhibit the corrosion of concrete
   - To increase the durability of concrete
   - To increase the resistance to chemical attack.

9. What is metakaoline?

   Metakaoline is refined kaolin clay that is fired (calcined) under carefully controlled conditions to create an amorphous aluminosilicate that is reactive in concrete. Like other pozzolans (fly ash and silica fume are two common pozzolans), metakaolin reacts with the calcium hydroxide (lime) byproducts produced during cement hydration.

10. What is the purpose of using accelerators?

- 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

11.Define chemical admixtures

Chemicals mixed with concrete ingredients and spread throughout the body of concrete to favorably modify the molding and setting properties of concrete mix known as chemical admixtures.

12.Define Mineral admixtures

It is a siliceous materials used to strengthen the durability properties that is classified as pozzolanic or cementitious materials. It acts as by-product agent. E.g.: fly ash

13.Define accelerators

Accelerators reduce the setting time and produce early removal of forms and speed up hardening. The common accelerators are $cacl_2$, Al_2cl, Nacl, Na_2SO_4.

14.What is the purpose of retarders?

Retarders increases the setting time of concrete mix and reduce the water cement ratio. Up to 10% water reduction is achieved.

15.Define plasticizers

Plasticizers are defined as chemical admixtures added to wet concrete mix to impart adequate workability properties.

16.Mention the types of plasticizers

a. Finely divided minerals
b. Air entraining agents
c. Synthetic derivatives

17.Define superplasticizers

Superplasticizers produce extreme workability and achieve reduction of water content without loss of water cement ratio i.e workability.

18.Mention few mineral admixtures.

a. Fly ash
b. Silica fume
c. Rice husk ash
d. Metakaoline
e. GGBFS

19.What are the various admixtures used other than chemical and mineral admixtures/

a. Gas forming and expansive chemicals
b. Pigments
c. Antifungal admixtures
d. Curing compounds
e. Sealants
f. Flooring
g. Guniting aids.

20.Name the admixtures available in India?

a. Plasticizers
   (a) Conplast P211- Water reducing plasticizers
   (b) Conplast P509- Water reducing plasticizers/High performance plasticizers
b. Super Plasticizers
   i. Conplast SP337- High workability aid
   ii. Conplast SP430- High range water reducer

21..Name any 2 natural pozzolonas.

Clay and shales, opalinccherts, diatomaceous earth, volcanic tuffs and pumicites.

22.Name any 2 artificial pozzolonas.

Surkhi, fly ash, blast furnace slag, silica fume, rice husk ash, metakaoline

16 marks

1. Explain plasticizer and super plasticizer?
2. Explain action of plasticizers and classification of superplasticizer.
3. Explain the various types of mineral admixtures
4. Mention some of the construction chemicals
5. Discuss briefly the role of admixture in concrete
6. Classify the admixtures in detail.
7. Write short notes on retarders.
8. Describe the role played by super plasticizers in concrete.
9. State any four pozzolanic admixtures and discuss briefly.

10. Write short notes on gas forming agents.
11. List the corrosion inhibiting agents and briefly explain any one of them.
12. Why are chloride based accelerators not used in pre-stressed concrete structures?
13. Distinguish between Plasticizers and Superplasticizers.
14. List the different types of workability aids.
15. How does a surface –active agent increase workability?
16. Why do superplasticizers perform better than surface-active agents?
17. What method will you adopt to cure concrete in areas of water shortage?
18. What are the different chemicals used to obtained the desired colours on a concrete surface?
19. How are mineral admixtures classified?
20. Distinguish between pozzolanic and or cementitious admixtures.

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UNIT III – PROPORTIONING OF CONCRETE MIX DESIGN
TWO MARK QUESTIONS

1. **Define mix design.**

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible.

2. **What are the variable factors to be considered in connection with specifying a concrete mix?**

- Water cement ratio
- Cement content or cement – aggregate ratio
- Gradation of the aggregates
- Consistency

3. **What are the various methods of proportioning?**

- 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

4. **What is meant by statistical quality control?**

The aim of quality control is to limit the variability as much as practicable. Statistical quality control method provides a scientific approach to the concrete designer to understand the realistic variability of the materials so as to lay down design specifications with proper tolerance to cater for unavoidable variations. The acceptance criteria are based on statistical evaluation of the test result of samples taken at random during execution.

5. **What are the common terminologies used in the statistical quality control?**

- Mean strength
- Variance
- Standard deviation
- Coefficient of variation

6. **How will you calculate the standard deviation?**

It is the root mean square deviation of all the results. This is denoted by σ.

$$\sigma = \sqrt{\sum (x - \bar{x})^2} / \sqrt{n-1}$$

7. What are the requirements of concrete mix design?

The requirements which form the basis of selection and proportioning of mix ingredients are:

- The minimum compressive strength required from structural consideration
- The adequate workability necessary for full compaction with the compacting equipment available.
- Maximum water-cement ratio and/or maximum cement content to give adequate durability for the particular site conditions
- Maximum cement content to avoid shrinkage cracking due to temperature cycle in mass concrete.

8. Mention the types of Mixes.
    1. Nominal Mixes
    2. Standard mixes
    3. Designed Mixes

9.What are the factors affecting the choice of mix proportions.

- Compressive strength
- Workability
- Durability
- Maximum nominal size of aggregate
- Grading and type of aggregate
- Quality Control

10.What are the factors to be considered for mix design.

- The grade designation giving the characteristic strength requirement of concrete.
- The type of cement influences the rate of development of compressive strength of concrete.
- Maximum nominal size of aggregates to be used in concrete may be as large as possible within the limits prescribed by IS 456:2000.
- The cement content is to be limited from shrinkage, cracking and creep.
- The workability of concrete for satisfactory placing and compaction is related to the size and shape of section, quantity and spacing of reinforcement and technique used for transportation, placing and compaction.

11.What are the methods used to concrete mix design for ordinary concrete.

There are numerous methods available for concrete mix design for ordinary concrete. The major methods are listed below

- IS method
- ACI method
- DOE method
- USBR method
- Arbitrary proportion

- Fineness modulus method
- Maximum density method
- Surface area method
- IRC-44 method
- RRL – method
- Minimum void method

12.What is proportioning of concrete mix

Proportioning of concrete mix is the art of obtaining a suitable ratio of the various ingredients of concrete with the required properties at the lowest cost.

13.What is the principle of mix proportioning

a. Environmental exposure conditions
b. Grades of concrete
c. Type of cement
d. Type and size of aggregates
e. Nominal maximum size of aggregates
f. Maximum and minimum cement content
g. Maximum free water cement ratio by weight
h. Degree of workability
i. Air entrained agent
j. Types of admixtures used if any
k. Maximum/ minimum density of concrete
l. Maximum/ minimum temperature of fresh concrete
m. Type of curing and mixing
n. Source of water

14.Mention the properties related to mix design

a. Durability
b. Workability
c. Strength
d. High strength concrete

15.Describe the physical properties of materials required to mix design

a. Cement
b. Aggregate
c. Water
d. Admixtures

16.Define Nominal mix

Nominal mix is permitted by IS456:2000 for concrete of strength lower than M_{25}

17.Define Design mix

Design mix is permitted by IS 10262-1982 and IS456:2000for concrete of strength Greater than M_{25} is design mix.

18.List out the advantages of Design mix

a. Properties of all materials are used.
b. Cement content is low and hence the mix design is economical.

19.List out the disadvantages of nominal mix

a. Nominal mix does not say which type of sand, cement, aggregate to be used.
b. High cement is required which leads to high cost.

20.What is ACI

American concrete institute was revised to include the use of entrained air.

21.What are the data used for ACI

a. Fineness modulus
b. Unit weight of dry rodded coarse aggregate
c. Specific gravity of cement, coarse and fine aggregate
d. Absorption characteristic of coarse and fine aggregate

22..What is meant by grading of aggregates?

Grading of aggregate means particle size distribution of the aggregate. If all the particleof an aggregate were of one size, more voids will be left on the aggregate mass. Properly gradedaggregate produces dense concrete and needs smaller quantities of fine aggregate and cement.Grading determines the workability of the mix, which controls segregation, bleeding,water-cement ratio, handling, placing, and other characteristics of the mix.

23.What are the factors affecting proportioning of concrete mixes?

Water cement ratio
Cement content
Temperature
Age of concrete
Size, shape and grading of aggregate
Curing

16 marks

1. Design a concrete mix for the following requirements using IS method. Also find the mix proportions by weight and by volume. M40 grade , OPC cement, sp gravity – 3.15, bulk density – 1440kg/m3, sand – grading zone I , sp gravity – 2.65, bulk density – 1610kg/m^3 Coarse aggregate – 10mm angular, sp gravity – 2.66, bulk density – 1580kg/m^3 Degree of workability – 0.85 compacting factor, quality control – very good
2. Design a M30 grade concrete with compaction factor of 0.9 by IS code method for moderate exposure and good quality control conditions using 20mm coarse aggregate which conforms to IS 383 grading . sp gravity of cement , fine and coarse aggregates is 3.15, 2.65 and 2.60 respectively. Water absorption of CA and FA is 0.5% and 1.0% respectively. Natural moisture content and grading zone of FA are 1.0% and zone III respectively. Assume suitable data if found necessary.
3. Design a concrete mix for construction of an elevated water tank . The specified design strength of concrete is 30mpa at 28 days measured on standard cylinders. Standard deviation can be taken as 4mpa. The specific gravity of FA and CA are 2.65 and 2.7 respectively. The dry rodded bulk density of CA is 1600 kg/m3 and fineness modulus of FA is 2.8. opc used A slump of 50mm is necessary. CA is found to be absorptive to the extent of 1% and free surface moisture in sand is found to be 2%. Assume any other data
4. Explain the procedure for road not no.4 method
5. Explain the procedure for DOE method
6. Discuss the various methods of proportioning.
7. Differentiate between nominal mix and design mix.
8. Compare ACI and IS method of concrete mix design.
9. Explain in detail, the step by step procedure of IRC 44 method of concrete mix design.
10. What are the parameters to be considered while designing a concrete

11. Design a concrete mix for M20 concrete for the following data by ACI method.

    Specific gravity of ordinary Portland cement = 3.15
    Specific gravity of fine aggregate = 2.65
    Specific gravity of coarse aggregate = 2.70
    Standard deviation = 4 N/mm^2
    Dry rodded bulk density of CA=1600kg/m^3
    Fineness modulus = 2.80
    Slump=50mm
    Assume any other data suitably, if necessary

12. What are the defects of the currently used method of mix proportioning in India? How can it be made more scientific?

13 . Explain how will you account for the moisture present in sand while mix proportioning.

14. List the methods used for mix proportioning indicating the drawbacks of each methods.

15. Explain the importance of the maximum size of aggregate for normal-strength concrete mix design.

16. Describe the significant variable affecting the workability of concrete.

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UNIT IV– FRESH AND HARDENED PROPERTIES OF CONCRETE

TWO MARK QUESTIONS

1. **Define fresh concrete.**
   - Fresh concrete or plastic concrete is defined is a freshly mixed material which can be moulded into any shape. The relative quantities of cement, aggregates and water mixed together, control the properties of concrete in the wet state as well as in the hardened state.

2. **Define workability.**
   - Its defined as the property of concrete which determines the amount of useful internal work necessary to produce full compaction.

3. **What are the important parameters of workability?**
   - Fully compaction of concrete
   - Lubrication to the concrete properties
   - Without segregation
   - For placing without loss of homogeneity.

4. **What is the quality of concrete?**
   - The quality of concrete is satisfying to the requirement of good workability.

5. **What are the factors affecting workability?**
   - Water content
   - Mix proportions
   - Size of aggregates
   - Shape of aggregates
   - Surface texture of aggregates
   - Grading of aggregates
   - Use of admixtures.

6. **What are the tests are used the measurement of workability?**
   - Slump test
   - Compacting factor test
   - Flow test.

7. **Define compacting factor.**
   - The compacting factor = $\frac{\text{Weight of partially compacted concrete}}{\text{Weight of fully compacted concrete}}$

8. **Define flow percent.**
   - Flow percent = $\frac{\text{Spread diameter in cm} - 25}{25} \times 100$
   - The value could range anything from 0 to 150 percent.

9. **Define segregation.**

- Its defined as the separation of the constituent materials on concrete. A good concrete is which all the ingredients are properly distributed to make a homogeneous mixture.

10. Define bleeding water percentage.

- Bleeding water percentage = $\frac{\text{Total quantity of bleeding water}}{\text{Total quantity of water in the sample of concrete}} \times 100$

11. Describe the setting time of concrete.

- The setting time of concrete is depends upon the w/c ratio, temperature conditions, type of cement, use of mineral admixture.
- The setting parameter of concrete is more of practical significance for site engineers than setting time of cement.

12. What are the various stages of manufacturing of concrete?

- Batching
- Mixing
- Transporting
- Placing
- Compacting
- Curing
- Finishing.

13. What are the methods for transportation of concrete?

- Mortar pan
- Wheel barrow, hand cart
- Crane, bucket and rope way
- Truck mixer and dumpers
- Belt conveyers
- Pump and pipe line
- Helicopter.

14. Define compaction of concrete.

- Compaction of concrete is the process adopted for expelling the entrapped air from the concrete. In the process of mixing, transporting, and placing of concerte air is likely to get entrapped air in the concrete.

15. What are the methods are adopted for compacting the concrete?

- Hand compaction
- Rodding
- Ramming
- Tamping
- Compaction by vibration
- Internal vibrator (Needle vibrator)
- Formwork vibrator (External vibrator)
- Table vibrator
- Platform vibrator
- Surface vibrator (Screed vibrator)
- Vibratory roller
- Compaction by pressure and jointing
- Compaction by spinning.

16. Describe curing.

- Curing can also be described as keeping the concrete moist and warm enough so that the hydration of cement can continue.

17. List out the types of curing methods.

- Water curing
- Membrane curing
- Application of heat
- Miscellaneous.

18. What are the ways of water curing?

- Immersion
- Ponding
- Spraying or fogging
- Wet covering.

19. What are the advantages for application of heat?

- Concrete is vulnerable to damage only for short time
- Concrete member can be handled very quickly
- A smaller curing tank will be sufficient
- Prestressing bed can be released early for further casting.

20. List out the terms in exposure of concrete in higher temperature.

- Steam curing at ordinary temperature
- Steam curing at high pressure
- Curing by infrared radiation
- Electrical curing.

21. What are the considerations involved in steam curing?

- An initial delay prior to steaming
- A period for increasing thee temperature
- A period for decreasing the temperature
- A period for retaining the temperature.

22. List the advantages derived from high pressure curing process.

- In exhibits higher resistance to sulphate attack, freezing and thawing action and the chemical action.
- In also exhibits lower drying shrinkage, and moisture movement.

23. What are the methods for making high strength concrete?

- Seeding
- Re vibration
- Use of admixtures
- High speed slurry mixing.

24. What are the techniques adopted in high strength of concrete?

- Compaction by pressure
- Helical binding
- Reactive powder concrete
- Polymerization in concrete.

25. Explain the testing of hardened concrete.

- Testing of hardened concrete plays an important role in controlling and conforming the quality of cement concrete works.

- It can also indicate strength and durability of concrete.

26. Explain compression test.

- Compression test is the most common test conducted on hardened concrete, partly because it is an easy test to perform and partly because most of the desirable characteristic properties of concrete are qualitatively related to its compressive strength.

27. Mention standard size of cube specimen.

- The size of cube specimen as 15 x 15 x 15 cm.

28. Explain the flexural strength of concrete.

- Concrete as we know is relatively strong in compression and weak in tension.
- In reinforced concrete members little dependence is placed on the tensile strength of concrete since steel reinforcing bars are provided to resist all tensile forces.
- Tensile stresses are likely to develop in concrete due to drying shrinkage, rusting of steel reinforcement temperature gradients and many other reasons.

29. Mention the standard size of prism moulds.

- The standard size of the prism is 15 x 15 x 70 cm.

30. How will you find the flexural strength of concrete.

- Its expressed as the moulds of rupture f_b

$f_b = \frac{p \times l}{b \times d^2}$

31. How will you calculate the vertical compression stress?

$\frac{2P}{\pi LD} \quad \frac{D^2}{r(D-r)} \quad -1$

When P is compressive load on the cylinder

L is length of the cylinder

D is diameter

r(D - r) is distances of the elements from two loads.

32. What are the factors influencing the strength results?

- The planeness of the end condition of specimen and capping material at the used for the cylinder affects the strength
- The effect of height to diameter ratio
- The rate of application of load has a considerable affect on the apparent strength of concrete.

33. Define dynamic modulus.

- When the pulse velocity measurements, the pulse modulus is called as “dynamic modulus”.

34.Define Abram’s water cement law.

According to Abram's water cement law, the strength of concrete depends on the water cement ratio used.

35.Define bleeding.

The tendency of water to rise to the surface of freshly laid concrete is known as bleeding.

36.What are the steps adopted to control bleeding.

- By adding more cement
- By using more finely ground cement
- By using little air entraining agent
- By increasing finer part of fine aggregate
- By properly designing the mix and using minimum quantity of water.

37.Define Seggregation.

The tendancy of separation of coarse aggregate grains from the concrete mass is called segregation.

38.What are the methods adopted to avoid seggragation of concrete.

- Addition of little air entraining agents in the mix.
- Restricting the amount of water to the smallest possible amount.
- Concrete should not be allowed to fall from larger heights.

39.What are the tests to find the workability of concrete?

Workability of concrete can be determined by

a. Slump test
b. Compacting factor test
c. Flow test
d. Kelly ball test
e. Vee bee test

40.What are methods adopted in compaction?

- Hand compaction
  - Rodding
  - Ramming
  - Tamping
- Compaction
  - Internal vibrator
  - Form work vibrator
  - Table vibrator
  - Platform vibrator
  - Surface vibrator (screed vibrator)
  - vi)Vibratory roller
- Compaction by pressure and jolting

- Compaction by spinning.

41.What are the characteristics of good concrete?

- It should have high compressive strength. The compressive strength should not be less than 15.5 N/ mm^2.
- On hardening, it should exhibit minimum shrinkage.
- It must be adequately dense. The density of a good concrete should be about 24 kN/m^3.
- It must be adequately durable to resist the effects of weathering agencies.
- It should have minimum creep
- It should have minimum thermal expansion so as to provide good resistance to fire.

42..List out the requirements of fresh concrete.

a. Mixability
b. Stability
c. Mobility
d. Compactability
e. Finishability

43.. Mention the values of different type of slump.

- True slump - up to 125mm from top
- Shear slump - up to 150 mm from top
- Collapse slump -150-225mm

44..List out the usage of slump values

- slump 0 – 25 mm are used in road making
- 10 – 40 mm are used for foundations with light reinforcement
- 50 - 90 for normal reinforced concrete placed with vibration

45.What is batching.

Batching is the correct measurement of various materials used in the concrete mix. It can be either volume or by weight.

46.How is weight batching is obtained

Weight batching is more accurate and hence preferred weighing can be done by

a. Simple spring balance
b. Platform weighing machines
c. Automatic weighing machines

2. Pan mixer

3. Truck mixer

47.What is hardened concrete and mention the factors influence its strength

Hardened concrete gives an overall idea about the quality of concrete. It depends on

a. Water cement ratio
b. Degree of compaction
c. Age of concrete
d. Richness of mix
e. Curing of concrete
f. Temperature of concrete.

48.Define shrinkage

Volume change due to loss of moisture affects durability and strength, causes cracks in concrete at different stage due to alkali aggregate reaction, sulphate action, settlement of fresh concrete is shrinkage.

49.Define creep.

When a concrete member is loaded it deforms to a certain extent as soon as the load is applied. When the load is kept constant, the deformation increases with time. This increase in strain under sustained stress is called creep of concrete.

50.Mention the test conducted to test the properties of hardened concrete.

a. Compression Testing Machine
b. Flexure Strength Testing Machine
c. Lateral Extensometer
d. Split Tensile Test
e. Shear strength
f. Bond strength

51.List out the factors affecting the results of strength test.

a. Size and shape of aggregate
b. Condition of casting
c. Moisture condition
d. Bearing condition
e. Rate of loading

16 marks

1. What are the various factors which affecting the workability of concrete?
2. Compare the relative merits and demerits of various workability tests.
3. Distinguish between segregation and bleeding of concrete.
4. What is re-vibration? Is it detrimental to concrete? Where is it practiced?
5. Why age factor not taken advantage of in IS 456-2000? Comment.
6. Discuss maturity of concrete? How is it measured? What are its practical uses in the concrete industry?

7. Describe the importance of curing? When should it be commenced? For how long should it be continued?
8. What is meant by autogenous healing of concrete? Comment on its relevance.
9. Under what circumstances is concrete subjected to fatigue stresses?
10. Is impact strength higher or lower than static strength? Give examples of two case where concrete is subjected to impact loading.
11. What is the relationship between the strength and density of concrete?
12. Define the term workability. What are the various tests conducted to determine the Workability of concrete and explain them.

CE 6002 CONCRETE TECHNOLOGY

UNIT V – SPECIAL CONCRETE

TWO MARK QUESTIONS

1. **Explain light weight concrete.**
   - The light weight concrete density varies from 300 to 1850 kg/m^3
   - It having low density
   - It helps to reduction of dead load, increases the progress of the building, and lowers handling costs.

2. **What are the adoptions of light weight concrete?**
   - Outlet for industrial wastes
   - Clinker
   - Fly ash
   - Slag.

3. **What are the different ways of achieving for light weight concrete ?**
   - By replacing the usual mineral aggregate by cellular porous or light weight aggregate.
   - By introducing gas or air bubbles in mortar. This is known as "aerated concrete".
   - By omitting sand fraction from the aggregate. This is called "no fines concrete"

4. **What are the types of natural light weight aggregates?**
   - Pumice
   - Diatomite
   - Scoria
   - Volcanic cylinders
   - Saw dust
   - Rice husk.

5. **What are the types of artificial light weight aggregate?**
   - Artificial cinders
   - Coke breeze
   - Foamed slag
   - Bloated clay
   - Expanded shale's and slate
   - Sintered fly ash
   - Expanded perlite
   - Thermo Cole beads.

6. **Explain pumice.**
   - Pumice is usually light coloured or nearly white and has a fairly even texture of interconnected cells of aggregate.
   - Pumice is the one of the oldest light weight aggregates which has been used roman structures.

7. **Define Diatomite.**
   - This is a hydrated amorphous silica derived from the remains of microscopic aquatic plants called as "Diatomite's".

8. **Explain scoria.**
   - Scoria is also light weight aggregate of volcanic origin which is usually dark in color and contains larger and irregularly shaped cells unconnected with each other.
   - Its slightly weaker than pumice.

9. **Define volcanic cinders.**
   - These are also loose volcanic product resembling artificial cinders.

10. Explain sawdust.

- Saw dust is manufactured by soft wood.
- The addition of lime to mix in an amount to equal to about 1/3 to 1/2the volume of cement will counteract this.
- The shrinkage of moisture movement of saw dust is also high.
- The practical mix of the ratio of 1:2 to 1:3 i.e., cement saw dust by volume.

11. Explain rice husk.

- Limited use of ricehusk, groundnut husk and bagasse have been used as light weight aggregates for the manufacture of light weight concrete for special purposes.

12. Describe brick bats.

- Brick bats are one of the types of aggregates used in certain places where natural aggregates are not available or costly.
- The brick bat aggregate cannot be really brought under light weight aggregates because the concrete made with this aggregate will not come under the category of light weight concrete.

13. Describe cinder, clinker and breeze.

- The term of cinder, clinker and breeze are used to cover the material partly fused or sintered particles arising from the combustion of coal.
- These days the use of these materials as light weight aggregate in the form of coarse or fine aggregate is getting abated owing to the wider use of pulverized coal rather than lumps of coal.

14. Explain foamed slag.

- Foamed slag is of the most important types of light weight aggregates.
- Its made by rapidly quenching blast furnace slag, a by-product, produced in the manufacture ofiron.

15. What are the properties of foamed slag?

- Free from contamination of heavy impurities
- Free from volatile impurities such as coke or coal
- Free from excess of sulphate.

16. Define bloated clay.

- When certain glass and shale's are heated to the point of incipient fusion, they expand or what is termed as bloat to many times their original volume on account of the formation of gas within the mass at the fusion temperatures.
- The cellular structure so formed is retained on cooling and the product is used as light weight aggregates.

17. Describe sintered fly ash.

- The fly ash is mixed with limited amount of water and is first made into pellets and then sintered at a temperature of 1000°C to 1200° C.
- The fly ash may contain some unburnt coal which may vary from 2 to 15 % or more depending upon the efficiency of burning.

18. Describe exfoliation.

- Raw vermiculate is a micaceous mineral and has a laminar structure.
- When heated with certain percentage of water it expands by delamination in the same way as that of slate or shale. This type of expansion is known as "exfoliation".

19. Define Exfoliated vermiculite.

- Due to exfoliation the vermiculite which may have expanded even as much as 30 times will have a density of only 60 to 130 kg/m^3.

20. Describe expanded perlite.

- Perlite is the one of the volcanic gases like pumice.
- This when crushed and heated to the point of incipient fusion at a temperature of about 900 to 1100°C it expands from a light cellular material with density of about 30 to 240 kg/m^3

21. Explain light weight aggregate concrete.

- Very often light weight concrete is made by the use of light weight aggregates.
- The light weight aggregates have different densities.
- By using expanded perlite or vermiculite a concrete density as low as 300 kg/m^3
- By using sintered fly ash, bloated clay a concrete density is 1900 kg/m^3
- The strength of the light weight concrete is varies from 0.3 N/mm^2 to 40 N/mm^2 .

22. Define aerated concrete.

- Aerated concrete is made by introducing air or gas into a slurry composed of Portland cement or lime and finely crushed siliceous filler so that when the mix sets and hardens uniformly cellular structure is formed. Though its called “aerated concrete”.

23. What are the ways of manufacturing from the aerated concrete?

- By the formation of gas by chemical reaction within the mass during liquid or plastic state.
- By mixing performed stable foam with the slurry.

24. Describe high density concrete.

- The high density concrete it must have unit weight ranging from about 3360 kg/m^3 to 3840 kg/m^3.
- It which about 50% higher than the unit weight of conventional concrete.

25. Explain sulphur infiltrated concrete.

- The impregnating porous materials like concrete with sulphur
- Sulphur impregnation has shown great improvement strength
- Also improving water permeability and resistance to corrosion.

26. What are the application of sulphur infiltrated concrete?

- In this concrete can be employed in present industry
- This method of achieving high strength can be used in the manufacture of precast elements, fencing posts, sewer pipes, railway sleepers etc.

27. Define Fibre reinforced concrete.

- Its defined as the addition of small closely spaced and uniformly dispersed fibres to concrete would act as crack arrester and would substantially improve its static and dynamic properties.
- This type of concrete is known as “fibre reinforced concrete”.

28. Mention the types of fibres used in fibre reinforced concrete.

- Steel fibres
- Polypropylene fibres
- Nylons

- Asbestos
- Coir
- Glass
- Carbon.

29. Define aspect ratio.

- Fibre is small piece of reinforcing material possessing certain characteristic properties
- They can be circular or flat
- The fibre is often described by a convenient parameter is called as “aspect ratio”.

30. What are the factors affecting thr properties of fibre reinforced concrete?

- Type of fibre
- Fibre content
- Orientation and distribution of fibres
- Mixing and compacting techniques of concrete
- Size and shape of aggregate.

31. What are the applications of fibre reinforced concrete?

- The fibre reinforced concrete is tied overlays in air field
- Using road pavements
- Industrial floorings
- the manufacturing of precast products (pipes, boats, beams, wall & roof panels).

32. Mention the advantages of fibre reinforced concrete.

- Increasing static and dynamic tensile strength
- Energy absorbing characteristics
- Better fatigue strength.

33. List out the current development of fibre reinforced concrete.

- High fibre volume micro fibre systems
- Slurry infiltrated fibre concrete (SIFCON)
- Compact reinforced composites.

34. Explain polymer concrete.

- Its defined as to improving and developing the properties of concrete has resulted in a new type of concrete is known as “polymer concrete”.

35. What are the types of polymer concrete?

- Polymer impregnated concrete (PIC)
- Polymer cement concrete (PCC)
- Polymer concrete (PC)
- Partially impregnated an surface coated polymer concrete.

36. Describe polymer impregnated concrete (PIC).

- Polymer impregnated concrete is the one of the widely used in polymer composite
- It is nothing but a precast conventional concrete, cured and dried oven, or by dielectric heating from which are the air in the open cell is removed by vacuum.

37. Mention the types of manometers are used in Polymer impregnated concrete (PIC).

- Methyl methacrylate (MMA)
- Styrene
- Acrylonitrile

- t- butyl styrene
- Other thermo plastic manometers.

38. Mention the types manometers are used in polymer cement concrete.

- Polyster styrene
- Epoxy styrene
- Furnas
- Vinylidene chloride.

39. What are the factors to be depend upon the depth of monomer penetration?

- Pore structure of hardened and dried concrete
- The duration of soaking
- The viscosity of the monomer.

40. List out the properties of polymer impregnated concrete.

- Stress- strain relationship
- Compressive strength
- Tensile strength.

41. What are the applications in polymer impregnated concrete?

- Manufacturing for prefabricated structural elements
- Pre stressed concrete
- Marine works
- Desalination plants
- Nuclear power plants
- Sewage works
- Ferro cement products
- For water proofing structures
- Industrial applications.

42.Where does high density concrete is applicable.

High density concrete is used as radiation shielding agent and it has satisfactory mechanical property

43..What are the types of concrete used?

Plum concrete, light weight concrete, air-entrained concrete, no-fines concrete, vaccumconcrete, water-proof concrete, reinforced cement concrete, pre-stressed concrete, cellular oraerated concrete, foamed concrete, pre-cast concrete.

44.What are the special methods of making high strength concrete?

- Seeding
- Revibration
- High speed slurry mixing
- use of admixtures
- Inhibition of cracks
- Sulphur impregnation
- Use of cementitious aggregates

45. Why high strength concrete is used for concrete repairs?

High strength concrete for concrete repair is used to provide a concrete with improved resistance to chemical attack, better abrasion resistance, improved resistance to freezing and thawing and reduced permeability.

16 marks

1. What is the significant difference between mixture proportioning of normal weight and light weight concrete?

2. Why is lightweight concrete preferred for construction particulars in multi-storey building? Explain with respect to their physical characteristics of lightweight aggregate concrete.
3. Discuss the importance and effects of water absorption and moisture content of lightweight aggregate concrete.
4. Discuss the environmental impact of normal-weight and light-weight concrete.
5. List the aspects of HPC that are related to strength and durability separately.
6. What are the important approaches for achieving durable concrete?
7. What are the methods of transportation of fluids and gases which aid permeation in concrete?
8. How does the porous structure of rice husk as influence the properties of fresh/hardened concrete?
9. What aspects are to be investigated for high performance in complex exposure conditions?
10. Describe the various applications of high-strength concrete in India.
11. What are the important long term properties of high strength concrete? Compare them with those of conventional concrete.
12. Describe the important fresh state properties of high-strength concrete.
13. Describe any one method of mix proportioning for high-strength concrete. Explain the significant difference between mix proportioning for conventional concrete and that for high-strength concrete.
14. Which theoretical considerations are important while selecting mix proportions for high-strength concrete?
15. Describe the typical composition of high-strength concrete.
16. How high-strength concrete be classified? Explain.
17. List the differences between polymer-impregnated concrete, polymer-modified concrete, and polymer concrete.
18. How the various quality controls is tests done to ensure good performance of polymer concrete?
19. What are the basic properties of fibre-reinforced concrete which can be advantageously made use of in the design of structural elements?
20. What is volume fraction made and how does it affects the behaviour in tension, flexture, and shear?
21. How is the toughness index obtained for a fibre-reinforecd concrete member subjected to compression?
22. What is compact cube test? How is it useful in determining the efficiency of FRC in shear?
23. Re confinement of concrete and fibre-reinforcement similar? If so how to use fibre concrete advantageously in resisting shear?
24. How is ready mixed concrete specified to satisfy the requirement in the fresh and hardened states?
25. In your opinion what are the reasons for delay in the use of ready mixed concrete in Indian construction industry?
26. Give the typical layout of ready mixed concrete plant.
27. What are the special precautions to be adopted on the site for efficiently using ready mixed concrete?
28. Give a list of laboratory equipment required to ensure the quality of ready mixed concrete supplied to the contractor.
29. What are the special features of transportation of ready mixed concrete from the plant to the site?
30. What special features are to be considered while handling and placing ready mixed concrete?