



R.C.Patel College Of Engineering & Polytechnic, Shirpur

Department of Civil Engineering



Course Title- Concrete Technology

Course Code -313322

Programme Name -Civil Engineering

Semester-Third

Unit	Title	COs	Learning hours	R Level	U Level	A Level	Total Marks
IV	Quality Control of Concrete	CO4	08	2	4	06	12

CONCRETE TECHNOLOGY

(SUBJECT CODE: 313322)

UNIT – IV

QUALITY CONTROL of CONCRETE



WORKABILITY TEST
(SLUMP CONE)



COMPRESSIVE STRENGTH TEST
(CUBE)



QUALITY CHECK
AND INSPECTION



DURABLE & STRONG
CONCRETE



TESTING



INSPECTION



CONTROL



QUALITY



DURABILITY



PERFORMANCE

PREPARED BY

Mr.Amol H.Patil

HOD, Civil Engineering Department
RCP COEP Shirpur.

4.1 * concrete operations :-

4.1.1 Batching :- Batching is the process of measuring and proportioning the ingredients of concrete before mixing.

* Types of Batching

1. Volume Batching :-

- Ingredients are measured by volume.
- Suitable for small works.
- Less accurate.

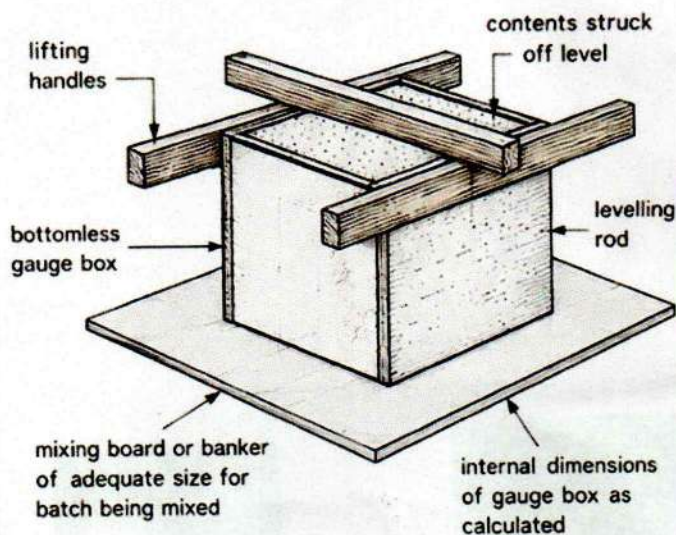
2. Weight Batching :-

- Ingredients are measured by weight
- more accurate
- preferred for important and large concrete works.

Diagram

Bottomless Gauge Box

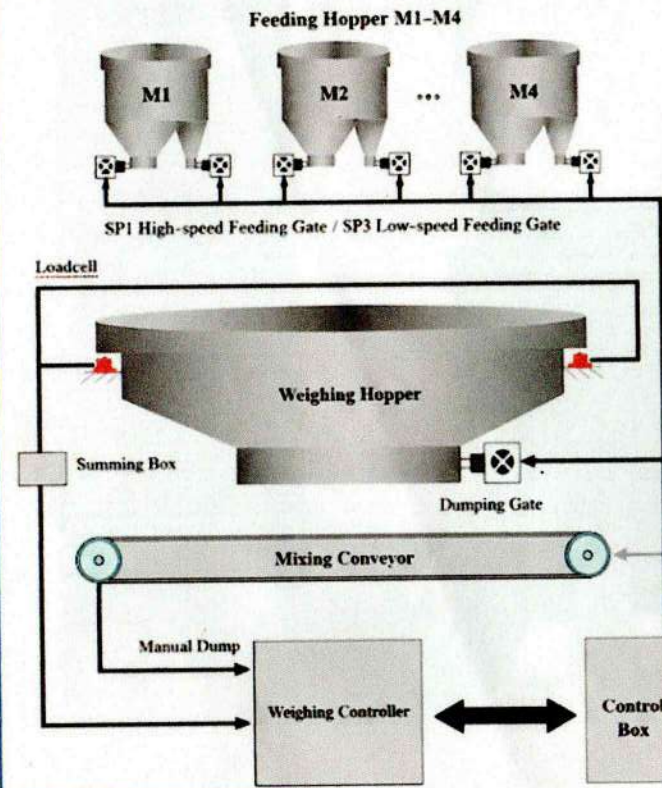
$$\text{length} = \frac{\text{volume}}{\text{width} \times \text{depth}} = \frac{0.033}{0.3 \times 0.3} = 0.366 \text{ m}$$



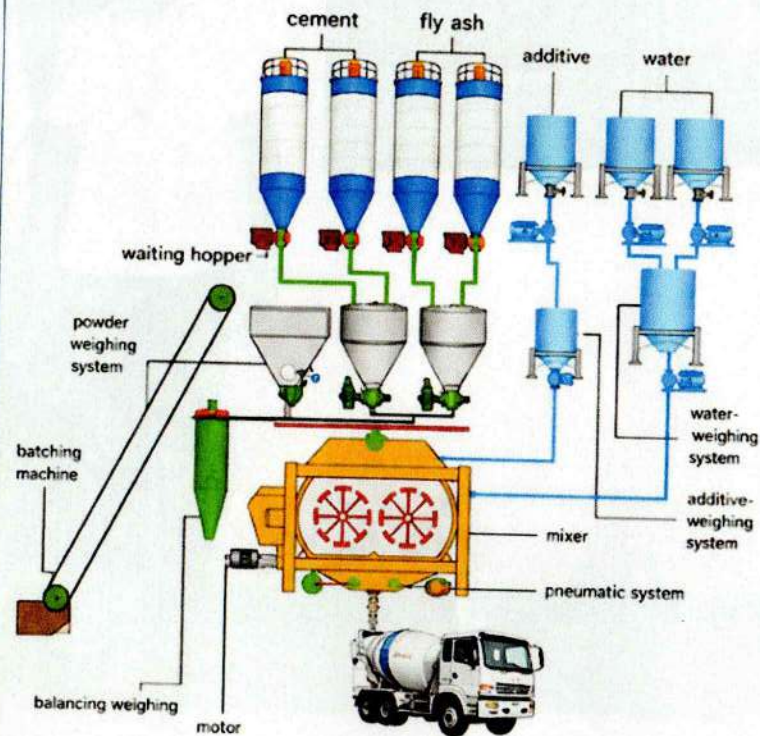
Aggregate Batching plant



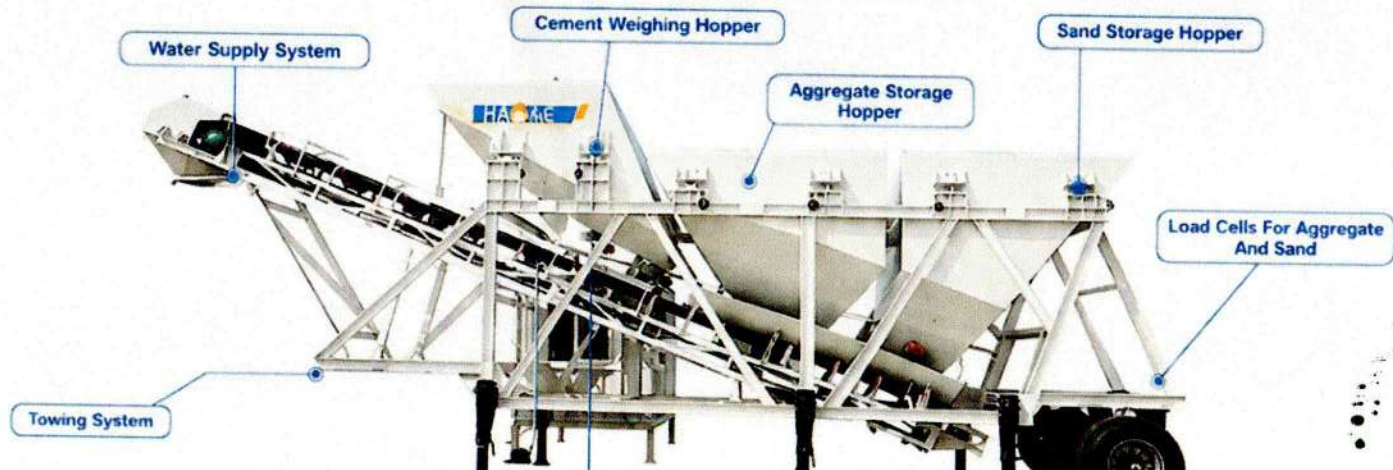
3) AUTOMATIC BATCHING SYSTEM – SCHEMATIC



4) WORKING PROCESS OF BATCHING PLANT



5) MOBILE BATCHING PLANT – MAIN COMPONENTS



4.1.2 Mixing of concrete :-

Defn :- mixing is the process of uniformly combining cement, fine aggregate, coarse aggregate and water to produce homogeneous concrete.

Types :-

- Hand mixing
- machine mixing

* Types of mixer :-

- Tilting drum mixer

- Non-tilting drum mixer

- Pan mixer



* Advantages of machine mixing :-

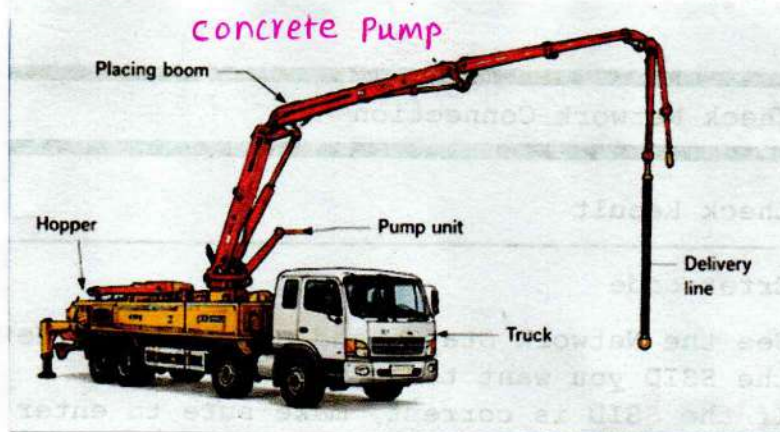
1. Uniform mixing
2. Saves labour
3. Saves time
4. Better quality
5. Suitable for large quantities.

4.1.3 Transportation of concrete :-

• transportation is the process of carrying freshly mixed concrete from the mixing place to the place of placing,

* modes of transportations :-

- Hand pan
- wheelbarrow
- Trolley
- Bucket
- chute
- crane
- Belt conveyor
- concrete pump
- Transit mixer

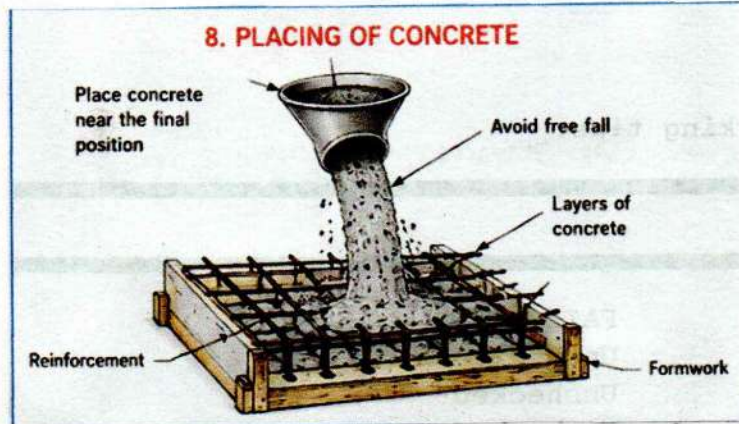


* precaution during Transportation :-

1. Avoid segregation
2. Avoid loss of water
3. Avoid contamination
4. minimize Transportation time
5. Avoid excessive vibration
6. prevent evaporation
7. maintain uniformity of concrete

4.14 Placing of concrete :-

placing is the process of depositing fresh concrete at its final required position in formwork



* Precautions during placing :-

1. Formwork should be clean and properly supported.
2. Reinforcement should be properly positioned.
3. Concrete should be placed near its final position
4. Avoid excessive free fall.
5. Avoid segregation
6. place concrete in suitable layer
7. compact each layer properly.
8. Avoid displacement of formwork
9. Avoid displacement of reinforcement.
10. maintain continuous placing as far as possible.

4.1.5 compaction of concrete :

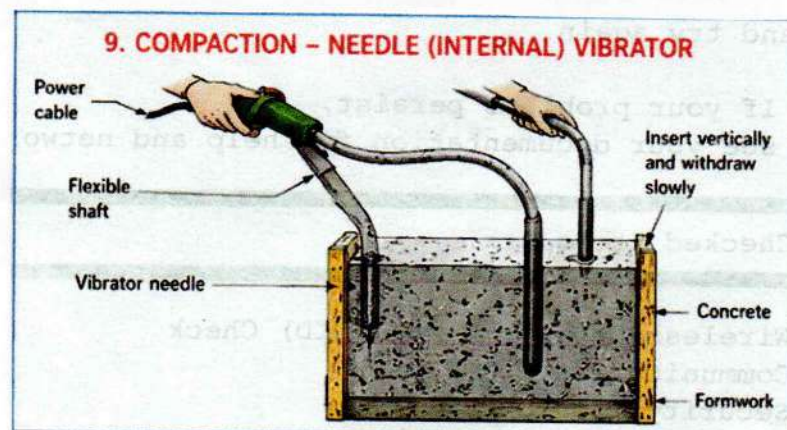
compaction is the process of removing entrapped air from freshly placed concrete to obtain dense concrete.

* Necessity of compaction :-

- 1) Increase strength
- 2) Increase density
- 3) Improve durability
- 4) Reduces permeability
- 5) prevents honeycombing
- 6) provide proper contact with reinforcement

* methods of compaction

- A) Hand compaction
 - 1) Rodding
 - 2) Tamping
 - 3) Ramming
- B) mechanical compaction
 - 1) Internal vibrator
 - 2) External vibrator
 - 3) surface vibrator
 - 4) Table vibrator



4.1.6 Finishing of concrete :-

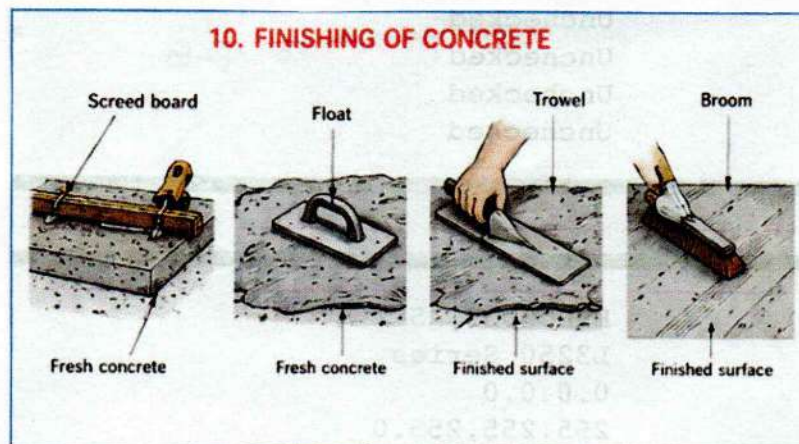
- finishing is the process of giving the concrete surface the required level, smoothness, appearance and texture

• Purpose :-

1. Obtained required level
2. Remove surface irregularities
3. Improve appearance
4. Obtain required texture

• Types of finishing :

1. screeding
2. floating
3. Trowelling
4. Broom finishing



4.1.7 Curing of concrete :-

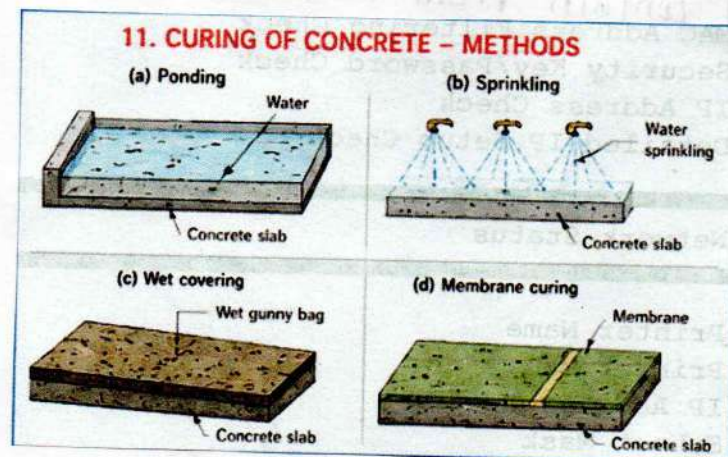
curing is the process of maintaining adequate moisture and suitable temperature in concrete after placing and finishing to facilitate hydration of cement.

* Necessity of curing :-

1. increase strength
2. Improve durability
3. Reduces shrinkage
4. Reduces cracking
5. Improve Impermeability
6. promote proper hydration

* methods of curing

1. ponding 2. sprinkling 3. wet covering 4. membrane curing
5. steam curing



* Ponding → This is the most common and inexpensive method of curing flat surfaces such as floor slabs, flat roofs, pavements and other horizontal surfaces.

* Application → slabs, floors and pavements.

2) sprinkling :- suitable for vertical surfaces, requiring frequent water application, especially in Hot weather.

Application :- Roads, slabs and large surfaces.

3) wet covering :- ideal for vertical surfaces like column and beams, using hessian cloth to retain moisture.

4) membrane curing :- A membrane is applied over the concrete surface to prevent loss of moisture.

Examples :- plastic sheets and curing compounds.

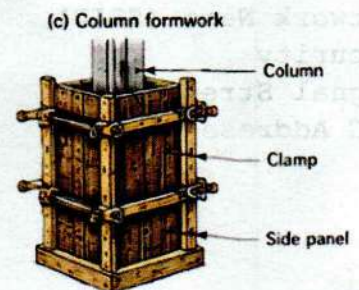
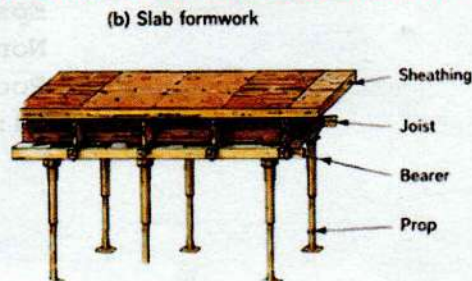
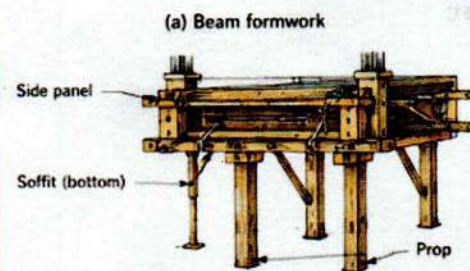
5) steam curing :-

Application → precast concrete products.

* 4.2 FORMWORK FOR CONCRETING

- Formwork is a temporary or permanent mould used to support and contain fresh concrete until it gains sufficient strength.

12. FORMWORK FOR BEAM, SLAB & COLUMN



formwork for Beams :- Important component as shown in fig. (a) Beam (b) side form (c) soffit form (d) prop (e) support (f) Bracing

* 4.2.3. Formwork for slabs

main components as shown in fig. (b)

- 1) sheathing
- 2) joints
- 3) Bearers
- 4) props
- 5) Bracing

* 4.2.4. formwork for columns

main components as show in fig (c)

- 1) side panels
- 2) clamps
- 3) Ties
- 4) supports
- 5) columns

* 4.2.5 materials used for formwork

- 1) Timber
- 2) plywood
- 3) steel
- 4) Aluminium
- 5) plastic

4.2.6. Requirements of good formwork

Good formwork should be:

1. strong,
2. Rigid
3. stable
4. watertight
5. Economical
6. Easy to erect
7. Easy to remove
8. Reusable
9. properly aligned
10. capable of providing the required shape and finish

* 4.2.7 stripping / removal of formwork

• stripping is the process of removing formwork after concrete has gained sufficient strength.

• minimum period before striking

For the Normal conditions specified in IS 456, the commonly used values are:

Type of formwork	minimum period
1. Vertical formwork to columns, walls and beams	16-24 hours
2. soffit formwork to slabs, props refixed	03 days
3. soffit formwork to beams, props refixed	07 days

Type of form work	min. period
4. props to slabs, span upto 4.5m	7 days
5. props to slabs, span over 4.5m	14 days
6. props to beams/ arches, span up to 6m	14 days
7. props to beams/ arches span over 6m	21 days

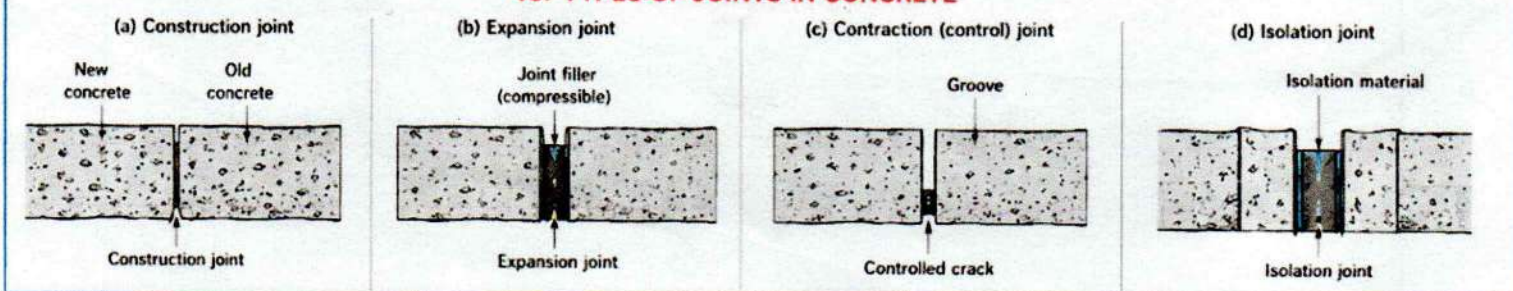
* 4.3 Joints in concrete construction

- A joint is a planned discontinuity in concrete provided to accommodate construction requirements or movement.

* Types :-

- 1) construction joint
- 2) Expansion joint
- 3) contraction joint
- 4) isolation joint

13. TYPES OF JOINTS IN CONCRETE



* 4.3.1 construction joint :-

A construction joint is provided when concreting is stopped and resumed later

* purpose :-

- Interruption in concreting
- End of days work
- Planned construction stages

* 4.3.2 Expansion joint :-

- An expansion joint is provided to accommodate expansion and contraction due to temperature and other volume changes.

* material used :-

- Bitumen
- CRK
- Rubber
- Fibre board
- compressible filler
- sealant.

* 4.3.3 contraction / control joint :-

- A contraction joint is provided to control cracking caused by shrinkage and temperature changes.

* 4.3.4 Isolation joint :-

- An isolation joint separates two structural elements so that they can move independently.

* Joining old and new concrete :-

* Need :- When a fresh concrete is placed against hardened concrete, the old surface must be properly prepared to obtain good bond.

* procedure :-

step 1: Roughening :- Remove weak surface materials and laitance.

step 2: cleaning :- clean dust, dirt and loose particles.

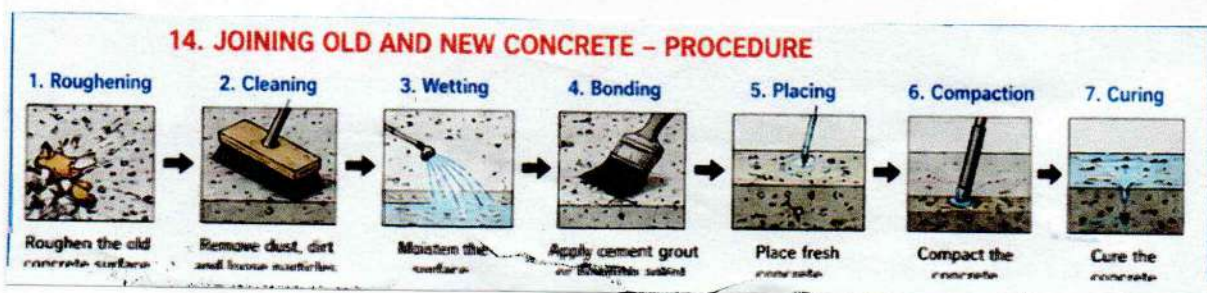
step 3: wetting :- moisten the old concrete surface appropriately.

step 4: Bonding :- Apply cement grout, mortar or specified bonding agent.

step 5: placing :- place fresh concrete against the prepared surface.

step 6: compaction :- compact the fresh concrete properly.

step 7: curing :- cure the new concrete properly.



* Materials used for filling joints :-

- | | |
|----------------|------------------------------|
| 1. Bitumen | 5. Polystyrene |
| 2. cork | 6. compressible joint filler |
| 3. Rubber | 7. sealant. |
| 4. Fibre board | |

References :-

1. M.S. Shetty & A.K. Jain, Concrete Technology : Theory and practice, S. Chand publishing. The 8th edition is listed as a 636 - page text covering concrete technology and Indian standards.
2. R.P. Rethaliya, concrete Technology, chatotar publishing House. Useful particularly for explanatory diagrams.
3. IS 456:2000, plain and Reinforced concrete- code practice
4. MSBTE previous question papers

Unit-4 Quality Control of Concrete (Question Bank)

Que. No.	2 marks Questions
1	State the concrete operations in sequence. [W-2024]
2	Enlist various concrete operations in sequence.
3	Give two points of comparison between volume batching and weight batching.
4	What is the significance of compaction?
5	Define formwork.
6	State any four requirements of good formwork.
7	Enlist materials used for formwork.
8	List any four materials used for filling joints in concrete. [W-2024]
9	Define construction joint.
10	Define expansion joint.
11	Define contraction/control joint.
12	Define isolation joint.
Que. No.	4 marks Questions
1	Enlist various concrete operations in sequence and explain any one in detail. [S-2025]
2	State four precautions to be taken during placing of concrete. [W-2024, W-2025]
3	Write the precautions to be taken while transporting concrete on site.
4	State the effects of under-compaction and over-compaction on properties of concrete.
5	Define formwork and state removal time of formwork for slab and beam as per IS 456:2000.[W-2024, W-2025]
6	State the stripping time of removal of formwork as per IS 456:2000 for specified beam and slab conditions.[S-2025]
7	Draw neat and labelled sketches of types of joints provided in concrete with their necessity.
8	State the procedure to join old and new concrete with neat sketch.