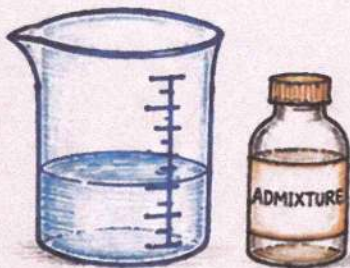


# CONCRETE TECHNOLOGY

(SUBJECT CODE: 313322)

## UNIT - V

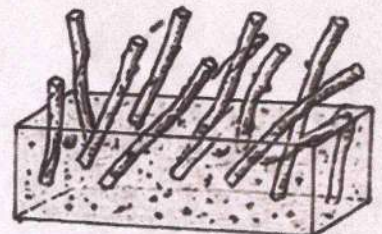
### ADMIXTURES IN CONCRETE AND SPECIAL CONCRETE



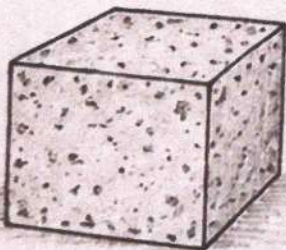
ADMIXTURE



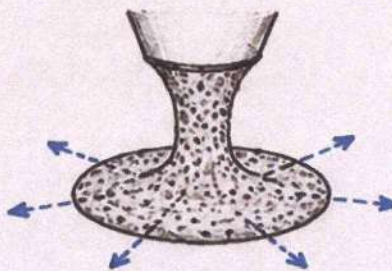
READY MIX CONCRETE



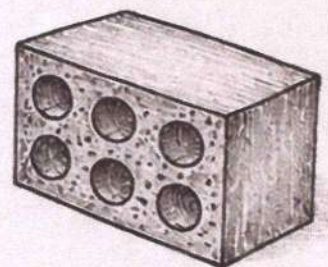
FIBRE REINFORCED  
CONCRETE



HIGH PERFORMANCE  
CONCRETE



SELF COMPACTING  
CONCRETE



LIGHT WEIGHT  
CONCRETE

⇒ PREPARED BY: ⇒

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# 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 |
|------|------------------------------------------|-----|----------------|---------|---------|---------|-------------|
| V    | Admixture in Concrete & Special concrete | CO5 | 07             | 04      | 08      | 00      | 12          |

## 5.1 Admixture in concrete :-

• concrete normally consists of four basic ingredients

- Cement
- sand
- Aggregate
- water

To improve the property of concrete in fresh and hardened states, a fifth ingredient called an **admixture** is added. Admixtures may be chemical or mineral substances added before or during mixing to modify the properties of concrete.

### \* Types of chemical Admixtures

#### 1. Accelerating Admixtures

These increase the rate of strength development and reduce setting time.

- Uses :-
- Early removal of formwork
  - Reduced curing time
  - Emergency repair work
  - cold weather concreting
  - Under water concreting

- Examples :-
- calcium chloride (earlier used)
  - Triethanolamine
  - Fluorosilicates.

#### 2. Retarding Admixtures

These slow down the hydration process and delay setting.

- Uses :-
- Hot weather concreting
  - Ready mix concrete
  - Large concrete pours
  - Long transportation periods

### \* Retarding plasticizers :-

combination of Retarder and plasticizer/superplasticizer.

#### Application :-

- Ready mix concrete
- slip-form construction
- Long-distance transportation

### Difference between Accelerating and Retarding Admixtures

| Retarding Admixture           | Accelerating Admixture            |
|-------------------------------|-----------------------------------|
| 1. slow hydration             | 1. speed hydration                |
| 2. Delay setting              | 2. Accelerate setting             |
| 3. suitable for hot weather   | 3. suitable for cold weather      |
| 4. Used in ready mix concrete | 4. used in underwater concreting. |

### 3. Water Reducing Admixtures (Plasticizers)

- plasticizers reduce water requirement while maintaining workability.

- \* Advantage :-
  - Higher workability
  - reduced segregation
  - reduced bleeding
  - better compaction

#### 4. Air Entraining Admixture :-

These create tiny air bubbles within concrete.

- Advantages :-
- Increased workability
  - Improved frost resistance
  - Reduced permeability
  - Better resistance to freezing and thawing

#### 5. superplasticizers :

High-range water-reducing admixtures

- properties :-
- Reduced water content upto 30%.
  - produce high workability concrete
  - Improved pumpability.
  - prevent segregation and bleeding

- Application :-
- self-compacting concrete
  - High rise buildings
  - Long-span bridges
  - Ready mix concrete

#### 5.2 cementitious (mineral) Admixtures

mineral admixtures are finely divided materials that react with calcium hydroxide and improve concrete properties.

- Benefits :-
- Reduce heat of hydration
  - Improve impermeability
  - Improve workability
  - Increase durability
  - Increase resistance to aggressive environments.

## 1. Fly Ash :-

Fly Ash is a by-product of thermal power plants.

### Advantages :-

- Higher ultimate strength
- Improved workability
- Reduced bleeding
- Reduced Heat of hydration
- Lower permeability
- Increase sulphate resistance
- Increased durability
- Reduced shrinkage
- Lower cost

### \* Environmental benefits :-

- Reduced carbon footprints
- Saves energy
- Utilizes industrial waste
- Improves sustainability

### \* Limitation :-

- Slow early strength gain
- Variable quality
- Availability issues

## 2. Ground Granulated Blast Furnace slag (GGBS)

A by-product of the iron and steel industry used as a partial replacement for cement.

### \* Advantages :-

- Reduced carbon emissions
- Improved durability
- Better workability
- Enhanced strength development
- Improved resistance to sulphates and chemicals

## \* Applications of GGBS

- Bridges
- Roads
- Dams
- precast concrete
- High performance concrete.

## 3. Silica Fume :-

A highly reactive pozzolanic material with extremely fine particles.

### Advantages :-

- Increase compressive strength
- Reduced permeability
- Improved durability
- Increases resistance to chemical attack
- produces dense concrete.

## 5.3 Special concrete :- 1. Ready mix concrete (RMC) :-

Special concrete is developed to meet specific construction requirements.

### \* Advantages :-

- Uniform quality
- Fast production
- Reduced site storage requirement
- Less pollution
- Better quality control

### \* Limitations :-

- Suitable mainly for large projects
- Requires transportation facilities
- Higher initial cost

## 2) Fibre Reinforced Concrete (FRC)

concrete containing fibre such as:

- steel
- glass
- polypropylene
- carbon
- bamboo fibres

### \* Advantages :-

- Higher tensile strength
- Better impact resistance
- Fire resistance
- Improved durability
- Lower self-weight

### \* Applications :-

- machine foundation
- canal lining
- precast units
- refractory lining

## 3) High performance concrete (HPC)

concrete having:

- High strength
- High workability
- High density
- Low permeability
- Excellent durability

- \* Application :-
- Nuclear power plant ,
  - Dams
  - Bridges ,
  - Airports
  - special structures

#### 4. self-compacting concrete (scc)

Concrete that compacts under its own weight without vibration.

##### \* Types :-

1. Power Type scc
2. Viscosity Agent Type scc
3. Combination type scc

##### \* Advantages :-

- No vibration required
- Better surface finish
- Faster construction
- Reduced labor requirement
- Improved durability

##### \* Limitation :-

- Higher material cost
- Careful curing required
- Possibility of shrinkage cracking

#### 5. Light weight concrete

Density : 300 to 1850 kg/m<sup>3</sup>

Advantages :-

- Reduced dead load

- Easier handling
- Reduced transportation cost
- Good thermal insulation
- Economical

### \* limitation of light weight concrete

- Lower strength
- Lower workability
- Higher porosity

### \* precast concrete

concrete members are manufactured in factories and transported to site

### \* Advantages :-

- Excellent quality control
- Economical mass production
- Better finish
- Faster construction

### \* limitations

- Transportation difficulties
- Requires heavy lifting equipment
- Risk of damage during handling

### \* References :-

1. M.S. Shetty, concrete Technology; Theory and practice, S. Chand
2. MSBTE - marathi - english learning material for concrete Technology.

**Unit-5 Admixture in Concrete & Special concrete (Question Bank)**

| Que. No. | 2 marks Questions                                                                 |
|----------|-----------------------------------------------------------------------------------|
| 1        | Define admixture and state its purposes.                                          |
| 2        | Define accelerating and retarding admixtures.                                     |
| 3        | What are plasticizers?                                                            |
| 4        | State two advantages of air-entraining admixtures.                                |
| 5        | What are super plasticizers?                                                      |
| 6        | Define mineral admixture.                                                         |
| 7        | State advantages / limitations of fly ash.                                        |
| 8        | What is GGBS? State its applications.                                             |
| 9        | What is silica fume?                                                              |
| 10       | What is function of retarders?                                                    |
| 11       | What are the different types of mineral admixture?                                |
| 12       | State any two advantages of using admixtures.                                     |
| 13       | Define lightweight concrete                                                       |
|          |                                                                                   |
| Que. No. | 4 marks Questions                                                                 |
| 1        | Explain types of chemical admixtures with uses.                                   |
| 2        | Differentiate accelerating and retarding admixtures.                              |
| 3        | Explain plasticizers, air-entraining admixtures and super plasticizers.           |
| 4        | Explain fly ash, GGBS and silica fume with advantages/applications.               |
| 5        | Explain Ready Mix Concrete with advantages and limitations.                       |
| 6        | Explain Fibre Reinforced Concrete with fibres, advantages and applications.       |
| 7        | Explain High Performance Concrete and its applications.                           |
| 8        | Explain Self-Compacting Concrete, types, advantages and limitations.              |
| 9        | Explain Lightweight Concrete with advantages and limitations.                     |
| 10       | List any four trade names for different types of admixtures.                      |
| 11       | Compare air entraining admixture with super plasticizers                          |
| 12       | Define cold weather concreting and enlist the effect of cold weather on concrete. |
| 13       | Enlist different cementitious admixtures used in concrete and explain any one.    |