**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.1**

To find out the amount of water absorbed by the bricks.

.

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Aim- To find out the amount of water absorbed by the bricks.

Apparatus -

1.Brick sample

2.Electric oven

3.Weighing balance

**Theory** –

The percentage of water absorbed by the brick with respect to its dry weight holds its importance to understand the quality of the brick as it affects the strength of the brick directly.

**Procedure** –

1. Select 3-4 brick sample randomly and put them in an electric oven at 105oC to 110oC after numbering them.
2. Weigh each of the dried brick after allowing them to cool to room temperature and immerse them into water at room temperature for 24hours.
3. Dry each brick properly with the help of a dry cloth and then weigh them.
4. Calculate the percentage of water absorbed.

# Observation Table:

|  |  |  |  |
| --- | --- | --- | --- |
| Weight of dry brick (w1) | Weight of brick immersed in water after  24hrs(w2) | Percentage of water absorbed  ( ) | Remarks |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Result: The grade of the brick as per the amount of water absorbed is ……….

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.2**

**To find the compressive strength of the brick**

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To find the compressive strength of the brick.

**Apparatus required:** Universal testing machine, Brick sample, Cement, Measuring scale.

Theory: The brick ultimately has to bear the compressive load, so it become of prime importance to find out the compressive strength of the same. Compressive strength means the compression load acting on the brick divided by the area of the brick upon which the load acts.

Final setting time is the total time from the addition of water till the cement paste completely loses its plasticity.

# Procedure:

1. Select a brick randomly and immerse it in the water for 24 hours.
2. Wipe the brick properly with dry cloth and fill the frog with 1:1 cement mortar.
3. The bricks are kept under damp jute bags for 24hours thereafter immerse in the water for 3 days
4. Wipe the bricks properly with dry cloth and measure the dimensions of the brick.
5. Place the brick under the compression testing machine with frog face upwards
6. The load is applied axially with the speed of 14N/mm2 until the brick is crushed. Note the load.

# Calculation:

Load at which the brick fails (L) =

Area of the brick directly under the load (A) =

Compressive strength=

Result: The compressive strength of the brick sample is=………….

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.3**

**To determine the fineness modulus of the given sample of coarse aggregate by sieve analysis method**.

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To determine the fineness modulus of the given sample of coarse aggregate by sieve analysis method.

Apparatus required: IS sieve required for sieve analysis as per IS2386-1963, Balance, and sieve shaker.

Theory: The fineness modulus is a numerical index fineness equal to the sum of cumulative percentages of material retained on set of ten sieves divided by 100. The aggregate passing through 4.75mm is called Fine aggregate. The aggregate retained on the 4.75mm sieve is called coarse aggregate. To provide the most economical mix and to get the optimum workability, fineness modulus is an important criteria.

Procedure:

1. Arrange the sieve in the order such as 80mm sieve is at the top and 150mm at the bottom.
2. Dry the aggregate properly before weighing and sieving.
3. Weigh 2kg of coarse aggregate and place it on the top most sieve.
4. Shake the sieve mechanically or manually. It should be taken care that the shaking should be of varied motion, backwards and forwards, left and right, circular clockwise, circular anticlockwise.
5. This should be continued for 2minutes or more.
6. On completion the material retained on each sieve shall be weighed.

# Observation:

|  |  |  |  |
| --- | --- | --- | --- |
| IS sieve | Weight if coarse  aggregate retained | Cumulative weight  retained | Cumulative  percentage retained |
| 80mm |  |  |  |
| 40mm |  |  |  |
| 20mm |  |  |  |
| 10mm |  |  |  |
| 4.75mm |  |  |  |

Result:- The fineness modulus of fine aggregate…..

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.4**

To determine the fineness modulus of the given sample of fine aggregate by sieve analysis method

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To determine the fineness modulus of the given sample of fine aggregate by sieve analysis method.

Apparatus required: IS sieve required for sieve analysis as per IS2386-1963, Balance, and sieves shaker.

Theory: The fineness modulus is numerical index fineness equal to the sum of cumulative percentages of material retained on set of ten sieves divided by 100. The aggregate passing through 4.75mm is called Fine aggregate. The aggregate retained on the 4.75mm sieve is called coarse aggregate. To provide the most economical mix and to get the optimum workability, fineness modulus is an important criteria.

# Procedure:

1. Arrange the sieve in the order such as 80mm sieve is at the top and 150mm at the bottom.
2. Dry the aggregate properly before weighing and sieving.
3. Weigh 2kg of fine aggregate and place it on the top most sieve.
4. Shake the sieve mechanically or manually. It should be taken care that the shaking should be of varied motion, backwards and forwards, left and right, circular clockwise, circular anticlockwise.
5. This should be continued for 2minutes or more.
6. On completion the material retained on each sieve shall be weighed.

.

# Observations:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| IS sieve | | Weight if coarse  aggregate retained | | Cumulative weight  retained | | Cumulative  percentage retained | |
| 4.75mm | |  | |  | |  | |
| 2.36mm | |  | |  | |  | |
| 1.18mm | |  | |  | |  | |
| 600u |  | |  | |  | |
| 300u | |  | |  | |  | |
| 150u | |  | |  | |  | |

Result:- The fineness modulus of fine aggregate…..

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.5**

To determine the workability of prepared concrete mix by compacting factor apparatus.

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To determine the workability of prepared concrete mix by compacting factor apparatus.

Apparatus required: Compacting Factor apparatus, Oil (for lubrication), prepared concrete mix, tamping rod.

Theory: The compacting factor test indicates the workability of a compacted concrete. The test is carried out with a compacting factor apparatus. It is the ratio of the compaction of concrete due to self weight and compaction of same concrete due to compaction done by mechanical way.

# Procedure:

1. Prepare a concrete mix of a specific ratio.
2. Apply oil to the apparatus for its smooth work.
3. Take a weight of empty cylindrical shape equipment W1.
4. Fill the prepared mix in the upper cone of apparatus.
5. Now, by the use of handle open the door of upper cone and allow the concrete to fall in lower cone due to self weight.
6. Repeat the same and then collect the prepared mix in cylindrical shape equipment due to self weight.
7. Take a weight of filled cylindrical shape equipment W2.
8. Now, fill the cylindrical equipment with the prepared concrete mix in three equal layers, each layers being tamped 25 times with a standard tamping rod.
9. Level the top layer and then take weight of that cylindrical equipment W3.

**Calculation:** Weight of empty cylindrical equipment W1

# Observation:

The compaction factor of the concrete mix ( : : ) =

General: If the concrete after the test when slump evenly all around is called true slump. In case of a very lean concrete, one-half of the cone may slide down the other which is called a shear slump; or it may collapse in case of very wet concrete.

If the slump value is between 25mm to 75mm, concrete is of medium workability and if slump value 75mm to 125mm the concrete is of high workability. If the slump value is almost zero, the concrete is very stiff and non-workable.

Result: The prepared concrete mix is of Workability.

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.6**

COMPRESSIVE STRENGTH OF CEMENT

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To determine the compressive strength of cement.

Apparatus required: Cube Mould of 70.6 mm size conforming to IS: 10080-1982, Cube Mould of 70.6 mm size conforming to IS: 10080-1982, Balance.

# Procedure-

* 1. Preparation of test specimens - Clean appliances shall be used for mixing and the temperature of water and that of the test room at the time when the above operations are being performed shall be 27 ± 2°C. Potable/distilled water shall be used in preparing the cubes.
  2. The material for each cube shall be mixed separately and the quantity of cement, standard sand and water shall be as follows:

Cement 200 g and Standard Sand 600 g

Water ((P/4)+3.0) percent of combined mass of cement and sand, where P is the percentage of water required to produce a paste of standard consistency determined as described in IS : 4031 (Part 4)-1988

* 1. Place on a nonporous plate, a mixture of cement and standard sand. Mix it dry with a trowel for one minute and then with water until the mixture is of uniform colour. The quantity of water to be used shall be as specified in step 2. The time of mixing shall in any event be not less than 3 min and should the time taken to obtain a uniform colour exceed 4 min, the mixture shall be rejected and the operation repeated with a fresh quantity of cement, sand and water.
  2. Moulding Specimens - In assembling the moulds ready for use, treat the interior faces of the mould with a thin coating of mould oil.
  3. Place the assembled mould on the table of the vibration machine and hold it firmly in position by means of a suitable clamp. Attach a hopper of suitable size and shape securely at the top of the mould to facilitate filling and this hopper shall not be removed until the completion of the vibration period.
  4. Immediately after mixing the mortar in accordance with step 1 & 2, places the mortar in the cube mould and prod with the rod. Place the mortar in the hopper of the cube mould and prod again as specified for the first layer and then compact the mortar by vibration.
  5. The period of vibration shall be two minutes at the specified speed of 12000 ± 400 vibrations per minute.
  6. At the end of vibration, remove the mould together with the base plate from the machine and finish the top surface of the cube in the mould by smoothing the surface with the blade of a trowel.
  7. Curing Specimens - keep the filled moulds in moist closet or moist room for 24 ± 1 hour after completion of vibration. At the end of that period, remove them from the moulds and immediately submerge in clean fresh water and keep there until taken out just prior to breaking.
  8. The water in which the cubes are submerged shall be renewed every 7 days and shall be maintained at a temperature of 27 ± 2°C. After they have been taken out and until they are broken, the cubes shall not be allowed to become dry.
  9. Test three cubes for compressive strength for each period of curing mentioned under the relevant specifications (i.e. 3 days, 7 days, 28 days)
  10. The cubes shall be tested on their sides without any packing between the cube and the steel plates of the testing machine. One of the platens shall be carried on a base and shall be self- adjusting and the load shall be steadily and uniformly applied, starting from zero at a rate of 35 N/mm2/min.

# Observation and Recording

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sr.**  **No.** | **Age of Cube** | **Cross Sectional Area(mm2)** | **Load(N)** | **Compressive Strength (N/mm2)** | **Avg. Compressive Strength (MPa)** |
| 1 | 3 days |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 | 7 days |  |  |  |  |
| 5 |  |  |  |  |
| 6 |  |  |  |  |
| 7 | 28 days |  |  |  |  |
| 8 |  |  |  |  |
| 9 |  |  |  |  |

Table 1: Recordings during Compressive Test on Cement

Calculation -The measured compressive strength of the cubes shall be calculated by dividing the maximum load applied to the cubes during the test by the cross-sectional area, calculated from the mean dimensions of the section and shall be expressed to the nearest 0.5 N/mm2. In determining the compressive strength, do not consider specimens that are manifestly faulty, or that give strengths differing by more than 10 percent from the average value of all the test specimens. After discarding specimens or strength values, if less than two strength values are left for determining the compressive strength at any given period, a retest shall be made.

1. The average 3 Days Compressive Strength of given cement sample is found to be …..…..
2. The average 7 Days Compressive Strength of given cement sample is found to be …..…..

# The average 28 Days Compressive Strength of given cement sample is found to be …..….

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.7**

To find out the initial and final setting of the given sample of cement.

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To find out the initial and final setting of the given sample of cement.

Apparatus required: Vicats apparatus with mould, IS Sieve No.9, Initial and final time needles, Measuring jar, Weighing balance, Stop watch.

Theory: The setting time of cement divided as the initial setting time and final setting. Initial setting time is the time from the addition of water to the time when the cement paste starts losing its plasticity.

Final setting time is the total time from the addition of water till the cement paste completely loses its plasticity.

# Procedure:

1. Prepare a cement paste by adding water lesser than required for standard consistency.
2. Start the stop watch as soon as the water is added.
3. Fill the vicats mould with the prepared cement paste. The mould should rest on anon- porous plate and the top of the paste must be smoothen off to the level of the top surface of the mould.

Initial setting time

1. Place the test block under the rod bearing the needle.
2. Lower the needle gently such that it touches the topmost surface of the cement paste and release it to allow it to penetrate through the paste. Repeat the procedure till the needle doesn’t pierce to a point 5.00mm approx. from the bottom of the mould.
3. Note the time elapsed till now. This gives the initial setting time of the cement.

Final setting time

1. Replace the needle with the final setting one with annular attachment.
2. The movable rod is slowly released. In the initial stage the needle and the collar may pierce through the paste.
3. The time when the needle makes an impression and the attachment fails to do so the stopwatch is paused. This gives the final setting of the cement paste.

# Result

Initial setting time=

Final setting time=

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.8**

To determine the soundness of the given sample of cement by Le-Chatelier method.

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To determine the soundness of the given sample of cement by Le-Chatelier method.

Apparatus: Le chatelier apparatus, weighing machine, glass plates, Water bath.

Theory: Soundness test is purposely performed to detect the presence of uncombined lime in cement. Le chatelier apparatus consist of a brass mould of diameter 30mm and height30mm. There is a split in mould and it does not exceed 0.50 mm. On the other side of the split, there are two indicators with pointed ends. The thickness of mould cylinder is 0.50mm.

# Procedure:

1. Prepare a cement paste of normal consistency.
2. Place the mould on glass sheet and fill the paste in the mould.
3. Cover the mould with another glass sheet and put a weight on it.
4. Submerge the whole assembly in water at a temperature of 27o (room temperature) for 24hrs.
5. Measure the distance between indicators to the nearest 0.5mm say d1.
6. Submerge the mould again at room temperature.
7. Boil the water such that it reaches to its boiling point in 25 to 30 minutes and keep it boiling for 3hrs.
8. Pull out the mould from water and allow it to cool.
9. Measure the distance between the same two indicators say d2.

# Calculation:

d2-d1 = expansion of cement.

Result = The expansion was found to be .

Remarks: The expansion should not exceed 10mm if so the cement must be rejected for construction purpose.

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.9**

SLUMP TEST ON CONCRETE

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To make quantities asses workability of prepared concrete mix.

**Apparatus required:** Slump cone, Temping rod, Measuring Scale, Prepared concrete mix.

Theory: The slump test indicates the behavior of a compacted concrete cone under the action gravitational forces. The test is carried out with a mould called the slump cone. It must be appreciated that the different concretes of same slump may, indeed, have different workability under the site condition.

# Procedure:

1. Prepare a concrete mix of a specific ratio.
2. The slump cone is placed on a horizontal and non-absorbent surface.
3. Fill the slump cone with the prepared concrete mix in three equal layers, each layers being tamped 25 times with a standard tamping rod.
4. Level the top layer, lift the mould vertically without disturbing the concrete cone.
5. The slump (subsidence of concrete in mm) is observed.

# Observation:

The slump subsidence of the concrete mix ( : : ) =

# General:

If the concrete after the test when slump evenly all around is called true slump. In case of a very lean concrete, one-half of the cone may slide down the other which is called a shear slump; or it may collapse in case of very wet concrete.

If the slump value is between 25mm to 75mm, concrete is of medium workability and if slump value 75mm to 125mm the concrete is of high workability. If the slump value is almost zero, the concrete is very stiff and non-workable.

Result: The prepared concrete mix is of Workability.

**CE402 Construction Technology**

**Civil Engineering**

**EXPERIMENT NO.10**

To find the percentage of water required to prepare a cement paste of standard consistency.

**Date of conduction:-**

**Date of submission:-**

**Submitted by other members:-**

**1.**

**2.**

**3.**

**4.**

**5.**

**Group no:-**

**Signature**

**Name of faculty in charge:**

**Name of Technical Assistant:**

Objective: To find the percentage of water required to prepare a cement paste of standard consistency.

Apparatus required: Vicats apparatus with plunger, IS sieve No.9, weighing balance, trowel, measuring jar.

Theory: The standard consistency of the cement refers to the consistency achieved by adding calculated amount of water to the cement to produce a homogeneous and uniform cement paste.

# Procedure:

1. Weigh 400g of cement sieved through IS sieve no.9 and add 30% of water i.e. 40ml to it.
2. Mix it thoroughly for 3-5minutes.
3. Fill the cement paste to the vicats mould and level the top surface smoothly with a trowel.
4. Place the mould centrally below the movable rod of the vicats apparatus.
5. Release the plunger quickly to allow it to penetrate it through the paste.
6. The settlement is noted and should be around 5-7mm from the bottom else repeat the procedure by preparing different cement paste with change percentage of water.

# Observation Table:

|  |  |  |  |
| --- | --- | --- | --- |
| S.No | Amount of water added | Penetration of the plunger  from the bottom | Remarks |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

Result: The normal/standard consistency of the cement =