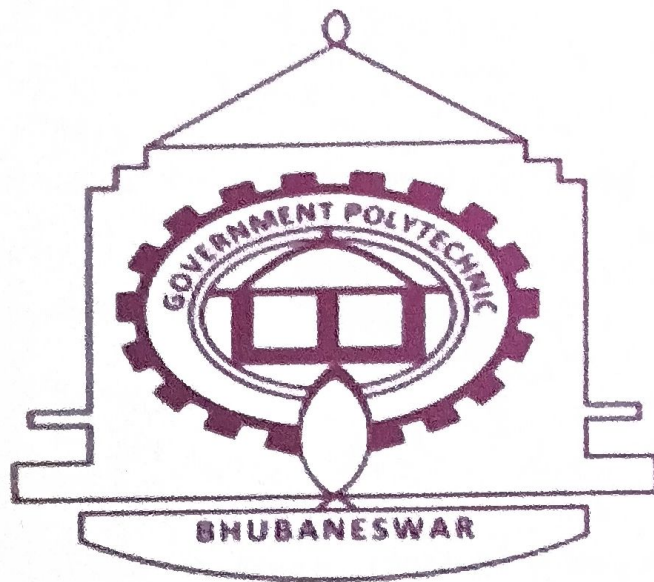


CIVIL ENGINEERING LABORATORY-I MANUAL



Government Polytechnic

Plot No: 1, Xavier Road, Maitri Vihar, Chandrasekharapur

Bhubaneswar, Odisha 751023

AIM OF THE EXPERIMENT: Determination of Fineness of Cement by sieving

APPARATUS REQUIRED:

IS 90 μ sieve, weighing balance, trowel, mixing tray, brush

MATERIAL REQUIRED:

Cement sample

THEORY:

The degree of fineness of cement is a measure of the mean size of the grains in the cement. Strength development in cement mortar in concrete depends on the fineness of cement. Finer cement has quicker action with water and gain high early strength. However the shrinkage and cracking of cement increases with fineness followed by quick deterioration. Therefore the fineness of cement has to be balanced with amount of coarseness in cement

PROCEDURE:

Place accurately weighed 100 gm cement free from lumps on the test sieve with pan to receive the weighed cement content

Shake the sieve and pan assembly gently for about 15 min.

Weigh carefully the residue left on the sieve.

OBSERVATION AND CALCULATION:

The mass of cement retained ON 90 μ I.S sieve is calculated as percentage of original mass.

OBSERVATION

Sl.No	Weight of Sample W_1 (gm)	Weight of Residue W_2 (gm)	Fineness(%)= $(W_2 / W_1) \times 100$
1.			
2.			
3.			

RESULT:

Fineness of given sample of cement =

CONCLUSION:

AIM OF THE EXPERIMENT: To determine the quantity of water required to produce a cement paste of standard consistency and the initial and final setting times for the given sample of cement.

APPARATUS REQUIRED:

- I. Vicat's apparatus
- II. Plunger
- III. Weighing balance
- IV. Gauging trowel.

RAW MATERIAL REQUIRED:

- I. Cement
- II. water

THEORY:

The standard consistency of a cement paste is defined as that consistency which will permit the vicat's plunger to penetrate to a point 33 to 35 mm from the top of the Vicat's mould. For finding out initial setting time, final setting time, soundness of cement and compressive strength of cement, it is necessary to fix the quantity of water to be mixed in cement in each case. This experiment is intended to find out the quantity of water to be mixed for a given cement to give a cement paste of normal consistency and can be done with the help of Vicat's apparatus.

PROCEDURE:

Prepare a paste of weighed quantity of cement (300 grams) with a weighed quantity of potable or distilled water, starting with 26% water of 300g of cement.

Take care that the time of gauging is not less than 3 minutes, not more than 5 minutes and the gauging shall be completed before setting occurs.

The gauging time shall be counted from the time of adding the water to the dry cement until commencing to fill the mould.

Fill the Vicat's mould with this paste, the mould resting upon a non porous plate.

After completely filling the mould, trim off the surface of the paste, making it in level with the top of the mould. The mould may slightly be shaken to expel the air.

Place the test block with the mould, together with the non-porous resting plate, under the rod bearing the plunger (10mm diameter), lower the plunger gently to touch the surface of the test block and quickly release, allowing it to penetrate into the paste.

This operation shall be carried out immediately after filling the mould.

Prepare trial pastes with varying percentages of water and test as described above until the amount of water necessary for making the standard consistency as defined above is obtained.

Express the amount of water as a percentage by weight of the dry cement.

OBSERVATIONS:

Sl. No	Wt. of Cement Taken (gm)	Wt. of Water Taken(gm)	Plunger Penetration (mm)	Time taken	Consistency (b)/(a)*100%

RESULT:

Normal consistency for the given sample of cement is

CONCLUSION:

- 7) Remove the mould from the water allow it to cool and measure the distance between the indicator points.
- 8) The difference between these two measurements represents the expansion of the cement.
- 9) For good quality cement this expansion should not be more than 10mm.

RESULT:

Expansion is mm.

CONCLUSION:

AIM OF THE EXPERIMENT

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

APPARATUS REQUIRED:

- I. Le-Chatelier apparatus
- II. Balance
- III. Weights
- IV. Water bath

MATERIAL REQUIRED:

- I. Cement
- II. water

THEORY:

It is essential that the cement concrete shall not undergo appreciable change in volume after setting. This is ensured by limiting the quantities of free lime, magnesia and sulphates in cement which are the causes of the change in volume known as unsoundness. Unsoundness in cement does not come to surface for a considerable period of time. This test is designed to accelerate the slaking process by the application of heat and discovering the defects in a short time. Unsoundness produces cracks, distortion and disintegration there by giving passage to water and atmospheric gases which may have injurious effects on concrete and reinforcement. The apparatus for conducting the test consists of small split cylinder of spring brass or other suitable metal of 0.5mm thickness forming a mould 30 mm internal diameter and 30mm high. On either side of the split mould are attached to indicators with pointed ends, the distance from these ends to the centre of the cylinder being 165 mm.

PROCEDURE:

- 1) Place the lightly oiled mould on a lightly oiled glass sheet and fill it with cement paste formed by gauging cement with 0.78 times the water required to give a paste of standard consistency.
- 2) The paste shall be gauged in the manner and under the conditions prescribed in determination of consistency of standard cement paste, taking care to keep the edges of the mould gently together
- 3) While this operation is being performed cover the mould with another piece of glass sheet, place a small weight on this covering glass sheet and immediately submerge the whole assembly in water at a temperature of $(27 \pm 2)^{\circ}\text{C}$ and keep there for 24 hours.
- 4) Measure the distance separating the indicator points.
- 5) Submerge the moulds again in water at the temperature prescribed above.
- 6) Bring the water to boiling, with the mould kept submerged for 25 to 30 minutes, and keep it boiling for three hours.

1.4 Determination of Compressive Strength of cement

AIM OF THE EXPERIMENT To determine the compressive strength of standard cement mortar cubes compacted by means of standard tamping.

APPARATUS REQUIRED:

- i. Cube moulds of size 7.06 cm
- ii. Trowel
- iii. Vibration machine
- iv. Weighing balance
- v. Compression testing machine

MATERIALS REQUIRED

- i. Cement
- ii. Sand
- iii. Water
- iv. Grease or lubricating oil

THEORY:

The compressive strength of cement mortars is determined in order to verify whether the cement conforms to IS specifications and whether it will be able to develop the required compressive strength of concrete. Strength test are not done on neat cement paste because of difficulties of excessive shrinkage and subsequent cracking of neat cement. Strength of cement is indirectly found on cement-sand mortar in specific proportion. The average compressive strength of at least three mortar cubes (area of the face 50 cm²) composed of one part of cement and three parts of standard sand should satisfy IS code specifications. The cubes are prepared for this purpose. The cubes are then tested in compression testing machine at the end on 3 days and 7 days.

PROCEDURE:

Mix proportions and mixing:

- 1) Clean appliances shall be used for mixing and the temperature of the water and that of the test room at the time when the above operations are being performed shall be $(27 \pm 2) ^\circ\text{C}$.
- 2) Place in a container a mixture of cement and standard sand in the proportion of 1:3 by weight mix it with a trowel for one minute and then with water until the mixture is of uniform colour.
- 3) In any case, it should not take more than 5 minutes to obtain uniform coloured mix.
- 4) The material for each cube shall be mixed separately and the quantity of cement, standard sand and water shall be as follows:

Cement = 200 gm

Standard sand = 600 gm

Water = $(P/4 + 3.0)$ % of Combined weight of cement and sand

where **P** is the percentage of water required to produce a paste of standard consistency.

- 5) Immediately after mixing fill the mortar into a cube mould of sizes 7.06cm.
- 6) Compact the mortar either by hand compaction in a standard specified manner or on the vibrating table.
- 7) Place the moulds in cabin at a temperature of $(27 \pm 2)^{\circ}\text{C}$ for 24 hours
- 8) Remove the specimen from the moulds and submerge them in clean water for curing.

Testing:

- 1) Take the cube out of water at the end of 3 days with dry cloth. Measure the dimensions of the surface in which the load is to be applied.
- 2) Place the cube in compressive testing machine and apply the load uniformly at the rate of 35 N/mm^2 ($350 \text{ Kg/cm}^2/\text{min}$).
- 3) Note the load at which the cube fails. Let it be '**P**'.
- 4) Calculate the compressive strength of the cube by using formula. The compressive strength at the end of three days should not be less than 16 N/mm^2
- 5) Repeat the same procedure (steps 1 to 4) for other two cubes.
- 6) Repeat the whole procedure (Step 1 to 5) to find the compressive strength of the cube at the end of 7 days and it should not be less than 22 N/mm^2 .

OBSERVATION:

Calculate the compressive strength from the crushing load and the average area over which the load is applied. Express the results in N/mm^2 to the nearest 0.05 mm^2 .

For 3 days strength:

Sl. No	Length (L) (mm)	Breadth (B) (mm)	Load (P) in N	Compressive Strength (N/mm^2)
1.				
2.				
3.				

Average compressive strength =

For 7 days strength:

Average compressive strength =

Sl. No	Length (L) (mm)	Breadth (B) (mm)	Load (P) in N	Compressive Strength (N/mm^2)
1.				
2.				
3.				