MODULE - I

PROPERTIES OF INGREDIENTS OF CONCRETE.

CONCRETE.

Concrete is a composite material composing of cement, aggregate, and water in suitable proportions. Which is also known as PCC. Plane cement concrete.

Fresh concrete.

When the setting and hardening process is not yet started, the concrete is known as Fresh concrete.

Fresh concrete can be deformed and poured which means it can be transported and used to fill moulds and form work.

REINFORCED CONCRETE.

Concrete is strong in compression but weak in tension, so steel reinforcement is used to take up tensile stresses at places where section is subjected to tensile stresses. Such a concrete is known as Reinforced Cement Concrete (RCC).

PROPERTIES OF CEMENT.

The various properties of cement are.

1. Fineness
2. Soundness
3. Consistency
4. Initial and final setting time
5. Compressive strength.
6. Heat of Hydration.

GRADES OF CEMENT.

The Ordinary Portland cement (OPC) was classified into three grades.

1. 33 grade
2. 43 grade
3. 53 grade.

Grades are depending upon the strength of cement at 28 days.

When tested as per IS: 4031-1988, the compressive strength at 28 days is not less than the specified grade of cement.

eg: In the case of 33 grade cement, when tested as per IS, the strength at 28 days is not less 33 N/mm^2.

AGGREGATES.

The aggregates occupy about 75% of volume of concrete and they greatly influence the properties of aggregate. They give body to the concrete, reduces shrinkage effect of cement and make the concrete durable.

Aggregates are divided into two groups.

1. Fine aggregate – aggregates less than 4.75 mm size
2. Coarse aggregate – aggregates more than 4.75mm size.

Properties of aggregate.

1. Particle shape
2. Surface Texture
3. Strength of aggregate
4. Specific gravity
5. Bulk density
6. Water absorption
7. Bulking of sand

GRADING OF AGGREGATES.

Gradation of the aggregates is almost as important as its quality is the grading of the aggregates has marked effect on the workability, uniformity and finishing qualities of concrete

IS sieves used for grading -

Fine aggregate – 4.75mm, 2.36mm, 1.18mm, 600micron, 300 microns, 150microns

coarse aggregate – 80mm, 40mm, 20mm, 10mm, 4.75mm, 2.36mm, 1.18mm, 600mic, 300mic, 150mic.

Water.

Water used for concrete is free from all impurities. Potable and drinking water with pH 6.5 to 7.5 is used for concreting.

ADMIXTURES USED IN CONCRETE

Admixtures are materials which is used in concrete is to change or modify the propeties of concrete. They may be classified according to the purpose for which they are used in concrete

1. Accelerating admixtures.
2. Retarding admixtures
3. Water reducing admixtures
4. Air-entraining admixtures

Water Cement Ratio.

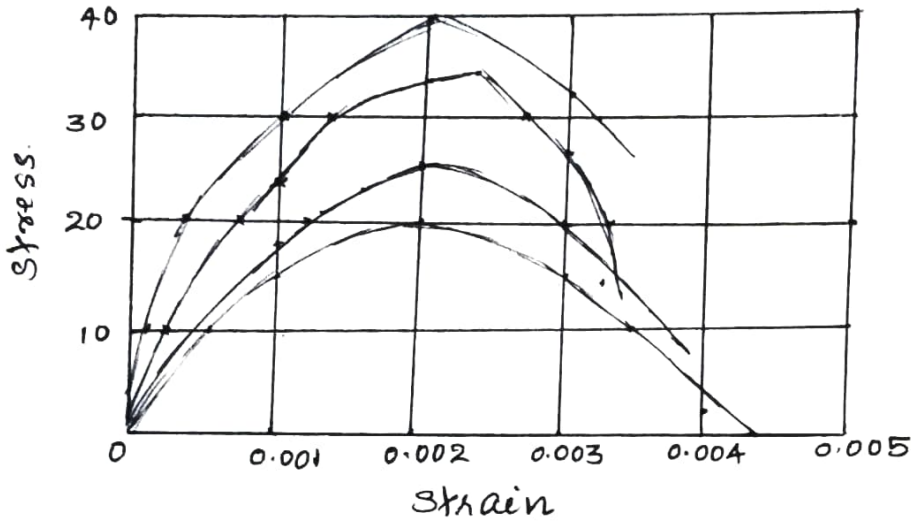
Water cement ratio is the ratio of volume of water to the volume of cement used in concrete.

Workability

Workability means the easiness of concrete mixing, transporting, placing and compaction with minimum loss of homogeneity.

STRESS - STRAIN CURVE OF CONCRETE

The stress strain behaviour of concrete is dependent on its strength, age at loading, rate of loading, properties of ingredients and the type and size of specimen.



From the above curve following points to be noted

1. Maximum compressive stress occurs approximately at a strain value of 0.002. The value of stress at 0.002 strain is known as the strength of concrete. For concrete strength means its compressive strength.
2. Lower strength concrete has its greater workability
3. Failure strain varies from 0.003 to 0.005 IS: 456-2000, Permits the maximum strain

in concrete in axial compression equal to 0.002. For bending compression, the stress strain curve is exactly the same but maximum strain permitted is 0.0035. In design the stress-strain curve is assumed parabolic upto a strain value of 0.002 and then a straight line upto a strain value of 0.0035.

Different grades of steel

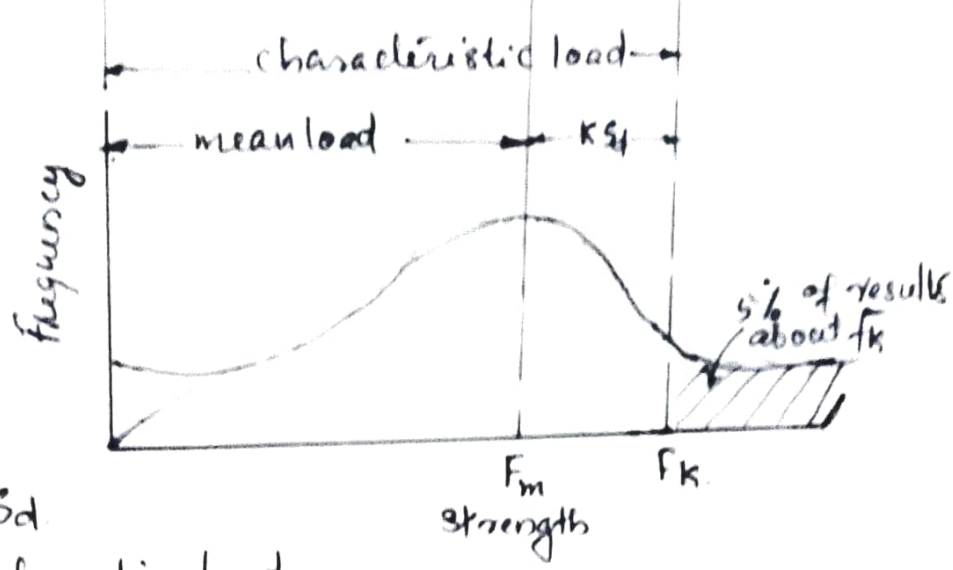
1. Mild steel bars Fe 250 - IS: 432-1966
2. ~~High Y~~
2. Hot rolled mild steel deformed bars - IS: 1139-1966
   i) Hot rolled medium tensile steel deformed bars
   ii) medium tensile steel
3. i) Hot rolled high yield strength deformed bars (HYSD) - IS: 1139-1966.
   ii) Cold worked HYSD bars.
4. i) Hard drawn steel wire fabric
   ii) Rolled steel made from structural steel.

Different methods of design.

1. Working stress method.
2. Limit state method.
3. Ultimate load method.

Characteristic load

A characteristic load is defined as that value of load which has 95% probability of not being exceeded during the life of the structure



$f_k = f_m + KSd$

F_k = characteristic load

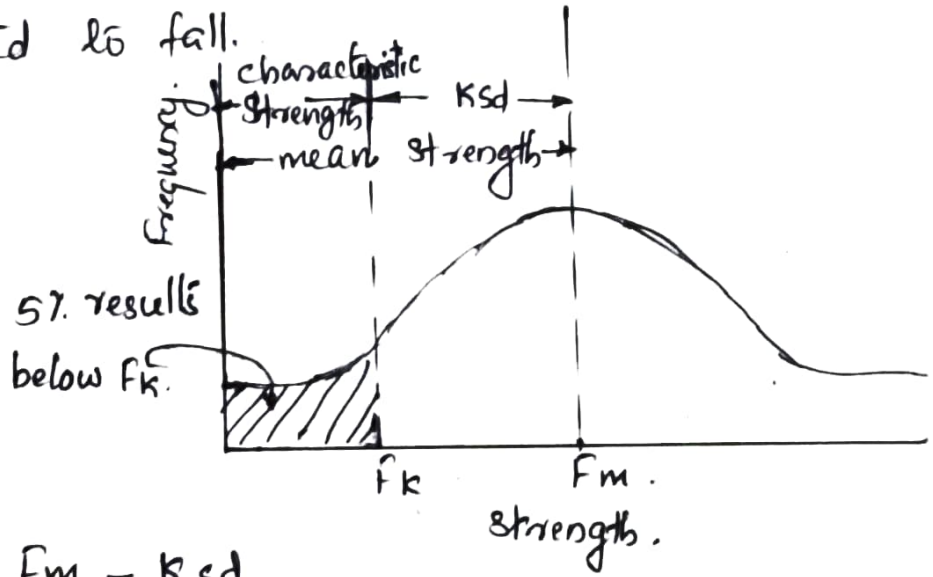
f_m = Mean load

K = Constant = 2·65

Sd = Standard deviation of the load

characteristic strength.

The term characteristic strength means that value of the strength of material below which not more than 5% of the test results are expected to fall.



$F_K = F_m - K sd$.

K = constant = 1·65

Sd = standard deviation.

F_K = characteristic strength.

F_m = mean strength.

Partial safety factors for loads and materials.

When assessing the strength of a structure or structural member for the limit state of collapse, the values of partial safety factor γ_m should be taken as 1.5 for concrete and 1.15 for steel.

A higher value of partial safety factor for concrete has been adopted because there are great chances of variation of strength of concrete due to improper compaction, inadequate curing, improper batching, mixing and variations in properties of grades.

For limit state of serviceability partial safety factor for both concrete and steel should be taken as 1.

Partial safety factor for loads. (γ_f)

$$\gamma_f = \frac{F_d}{F}$$

F_d = design load.

F = characteristic or working or service load.

$\therefore$ design load $F_d = F \times \gamma_f$.

* What is limit state? What are the various limit states for section is designed?

The aim of this method is that the

structure should be able to withstand safely all the load that are liable to act on it throughout its life and it should also get satisfied the serviceability requirements of limiting deflection and cracking. The two types of limit states ~~collapse~~ are

i limit state of collapse
ii limit state of serviceability

The following limit state of collapse are considered in designs,

(a) Limit state of collapse in flexure (Bending)
(b) Limit state of collapse in compression.
(c) Limit state of collapse in shear
(d) limit state of collapse in torsion.

Limit state of serviceability ~~are~~ considering designs,

(a) limit state of deflection
(b) limit state of cracking.

* Explain the limit state method of design?
Answer: same as above.
* Explain limit state of collapse and serviceability
Answer: Same as above.