4.5 STRESS-STRAIN CURVE FOR CONCRETE

Stress (σ)

f_{ck} =Characteristic Curve of cube

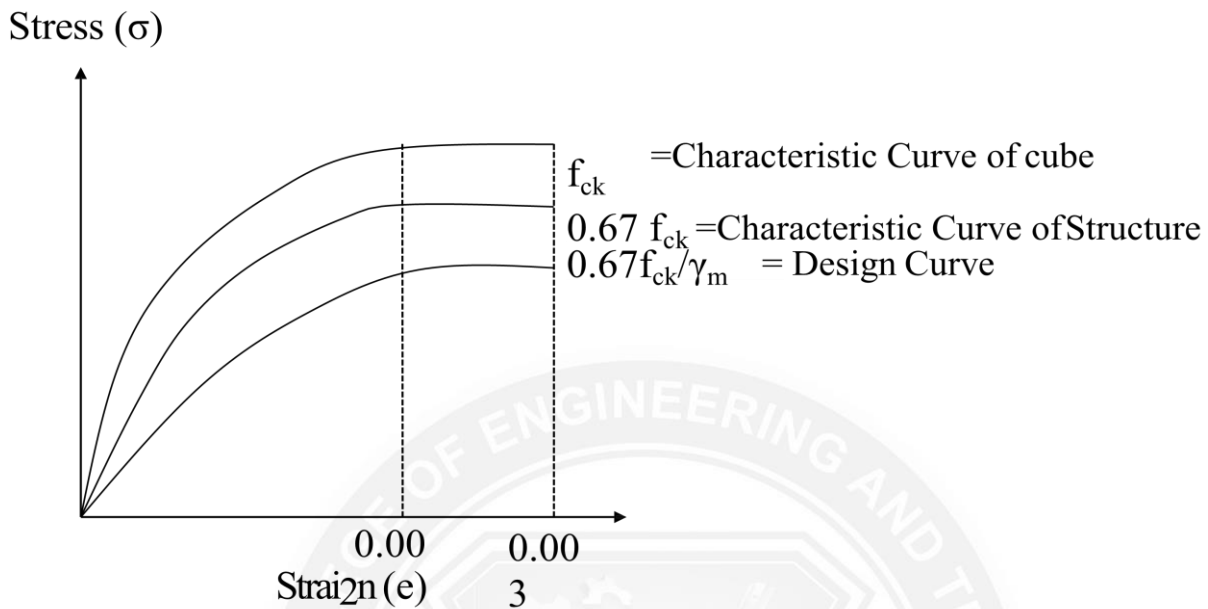0.67 f_{ck} =Characteristic Curve ofStructure

0.67f_{ck}/γ_m = Design Curve

0.00
2

0.00
3

Strain (e)

- The Figure showing the stress – strain curve for concrete. Usually, the curve may be assumed to be rectangular, trapezoidal, parabola or any other shape.

- The curve will be linear in lower grade of concrete and nonlinear in higher grade of concrete.

- The reason for this nonlinear behavior is that micro cracks are formed,

  i.   At the interface between aggregate particles and cement paste as a result of the differential movement between the two phases, and

  ii. Within the cement paste itself.

- These cracks are formed as a result of change in temperature and moisture and the application of load.

- Concrete taken through a cycle of loading and unloading will exhibit a stress-strain curve as shown in the figure.

- For design purposes, the compressive strength of concrete in the structure shall be assumed to be 0.67 times the characteristic strength.

- The partial safety factor γ_m, = 1.5 shall be applied in addition to this.

- While studying the stress-strain relationship, tensile strength of the concrete is ignored.

- The concrete will not return to its original length when unloading mainly due to creep and micro-crackling.

- There will be a residual strain at zero loads. This is known as hysteresis loop.

- Hysteresis loop is mainly related to micro-cracking.

- Providing the maximum applied load is not greater than the normal working load, and then further cycles of loading and unloading will produce small size hysteresis loops.

- This because the majority of the micro-cracks are formed on the first application of the load.