Design Philosophy (Week1)

- The design of a structure may be regarded as the process of selecting proper materials and proportioned elements of the structure, according to the art, engineering science and technology. In order to fulfill its purpose, the structure must meet its conditions of safety, serviceability, economy and functionality.

Limit state design (Week1)

- It is a further step in the strength design method. It indicates the state of the member in which it ceases to meet the service requirements, such as, loosing its ability to withstand external loads or local damage. According to limit state design, reinforced concrete members have to be analysed with regard to three limit states:
- Load carrying capacity (involves safety, stability and durability)
- Deformation (deflection, vibrations, and impact)
- The formation of cracks
- The aim of this analysis is to ensure that no limiting sate will appear in the structural member during its service life.

Fundamental assumptions for Reinforced Concrete's Behavior (Week 2)

- Reinforced concrete's sections are heterogeneous, because they are made up of two different materials - steel and concrete. Therefore, proportioning structural members by ultimate stress design is based on the following assumptions:
- Strain in concrete is the same as in reinforcing bars at the same level, provided that the bond between the concrete and steel is adequate
- Strain in concrete is linearly proportional to the distance from the neutral axis.
- Modulus of elasticity for all grades of steel is taken as Es = 200 kN/mm2. The stress in the elastic range is equal to the strain multiplied by Es.
- Plane cross sections continue to be plane after bending.
- Tensile strength of concrete is neglected because:
  - Concrete's tensile strength is about 1/10 of its compressive strength.
- Cracked concrete is assumed to be not effective Before cracking, the entire cross section is effective in resisting the external moments.
- The method of elastic analysis, assuming an ideal behavior at all levels of stress is not valid. At high stresses, non-elastic behavior is assumed, which is in close agreement with the actual behavior of concrete and steel.
- At ultimate strength, the maximum strain at the extreme compression fibers is assumed to be equal to 0.0035 by the BS 8110 code provisions. At the ultimate strength, the shape of the compressive stress distribution may be assumed to be rectangular, parabolic or trapezoidal.