Syllabus:

- Propeties of materials
- Simple and temperature stresses (Hook's law)
- Shear force and Bending moment
- Shear stress and bending stress distribution.
- Principle stresses.
- Theories of failure
- Torsion of shaft
- Deflection of Beams
- Pressure vessel
- Theory of columns.
- Principle axis, M.I., P.J. etc.

Reference Books.

- Mechanics of materials by James M. Gose
- Mechanics of material by Timoshenko.
- Mechanics of material by Gore and Timoshenko
- Mechanics of material by B.C. Punmia.
- L.S. Meghi - Strength of materials

Properties of metals:

Q. Why mild steel is most commonly used metal in civil structure

Ans:

(i) High ductility - (it gives initial warning of failure in RCC structures)

(ii) Equally strong in tension and compression - (it is suitabl for cyclic loading and load inversion conditions)

(iii) $\alpha_{concrete} = \alpha_{steel}$ (coefficient of thermal expansion) - (due to change in temperature, thermal stresses between concrete and steel will not be developed and bond will not break).

(iv) $E_{compression} \simeq E_{tension}$ - (Young's modulus of steel in tension and compression are nearly equal)

Note:

It makes easy to analyse in bending, moreover the stresses in tension and compression can be simultaneous determined by using same Young's modulus. This is true for most of the ductile metals. However, some brittle materials shows different Young's modulus in tension and compression.

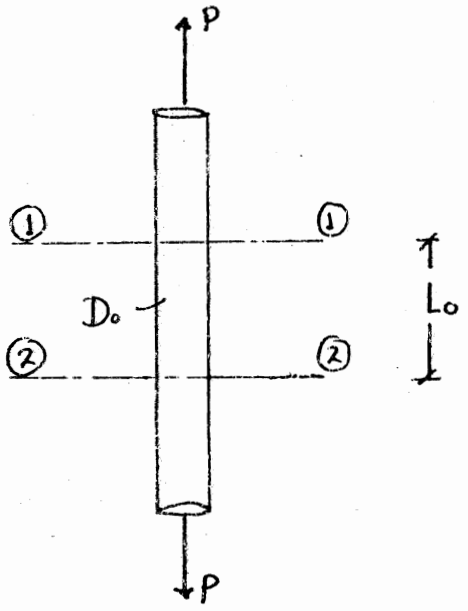
(v) It is recyclable, weldable, cheaper than other metals

Tension test in Mild steel:

The test is conducted by Universal Testing Machine (UTM)

(i) UTM can be used to find Tensile strength, compressive streng or shear strength.

(ii) The loading is gradually applied (static loading) in which load increases from zero to peak.



L_o - Gouge length = 2.0"

D_o - Gauge dia. = 0.5"

$\frac{L_o}{D_o} = 4$

Fig. Tension test on Mild steel

(iii) The testing specimen of steel is a solid cylindrical bar of gouge length to gouge dia. ratio equal to 4.

(iv) The loading is standardised by ASTM (American standards for testing materials) Hence standardised curve for stress-strain is plotted for L_o/D_o ratio 4.

On the basis of static loading following two types of stress-strain curves can be plotted.

1. Engineering curve / Nominal curve (σ_o Vs ϵ_o)
2. Actual curve / True curve (σ_a Vs ϵ_o)

Pressure is external load per unit area but stress is internal resistance per unit area.

Stress :

Stress is internal resistance per unit area offered by the metal against the deformation.

Units are N/mm^2 - MPa

N/m^2 - Pascal.