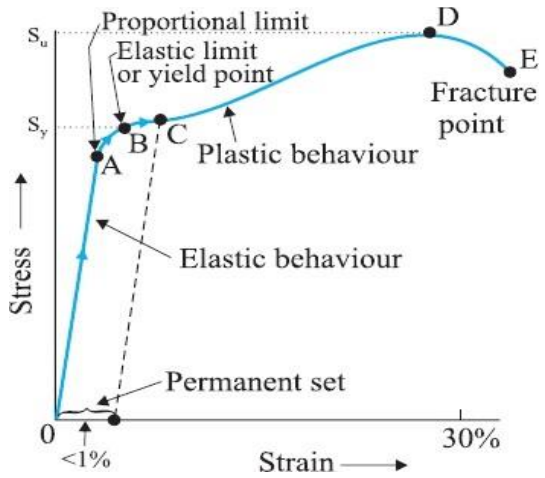
2.3 Stress – Strain diagram

Consider a wire which is rigidly fixed at one end and gradually loaded at the other end. The corresponding strain produced for the different loads are noted until the wire breaks down. A graph is plotted between strain along X – axis and stress along Y – axis. This graph is known as **stress – strain diagram**.



- In the region between O to A, the curve is linear. In this region, **Hooke's law** is obeyed and the solid behaves as an elastic body.
- In the region from A to B, stress and strain are not proportional. The point B in the curve is known as **yield point** (also known as **elastic limit**) and the corresponding stress is known as yield strength ($\mathbf{S_y}$) of thematerial.
- If the load is increased further, strain increases rapidly even for a small change in the stress. When the load is removed at point C, the body does not regain its original shape. In this case, even when the stress is zero, the strain is not zero. The material is said to have a **permanent set**. The deformation is said to **be plastic deformation**.
- At the point D on the graph, the stress developed is maximum, which is called as **ultimate tensile strength ($\mathbf{S_u}$)** of the material.
- Beyond this point, additional strain is produced even by a reduced applied force and **fracture occurs at point E**. If the ultimate strength and fracture points **are close, the material is said to be brittle** and if they are **far, the material is said to be ductile**.

Uses of stress – strain diagram

1. It is used to categorize the materials (ductile, brittle and plastic).

2. It is used to found the amount of deformation.
3. It is used to calculate the strength of the materials.