

Strength of Materials

Objectives

1. Define basic terms.
2. Differentiate between stress and strain.
3. Differentiate and give examples of the 3 principle stresses.
4. Draw and label a “typical” stress-strain or load-strain curve.
5. Explain the effect and locate the stresses during the loading of an object.
6. Analyze and describe the effects of force on growth.
7. Explain examples of strength of materials in the clinic.
8. Differentiate among resilience, damping, and toughness.
9. Differentiate between fatigue and creep.
10. Give examples of strength of materials in the medical, rehabilitation, sports medicine, and exercise science fields.

Loading

Knowledge of the behavior of biological materials and biomaterials is important for the practitioners who deal with the human body. Biological materials are often affected by forces external to the material. Research continues to reveal the responses of loads on the mechanical characteristics of bone, cartilage, vertebral discs, menisci, tendons, and ligaments. Recent studies have been investigating the responses of these structures at the cellular level to determine cell-mediated remodeling events that occur when loads are applied.

Knowledge of the effect of loads on biomaterials provides an understanding for the repair or replacement of biological tissues. A newly developed approach to studying biomaterials is biomimetics. This approach involves imitating living tissues with nonliving materials. The use of biomaterials has advanced from inert materials to materials that assist with regeneration.

As a load is imposed upon the material, the load tends to deform (change in size or shape) the material. In turn, the material tends to resist this deformation. The amount of deformation depends upon the magnitude of the load and the ability of the material to resist the deformation. The ability of the material to resist deformation is often referred to as the strength of the material.