

1. Typical stress-strain behavior for a metal shows elastic and plastic deformations. Please use the 0.002 (0.2%) strain offset method to determine the proportional limit P and the yield strength σ_y . (10%) The fracture strength corresponds to the stress at fracture. The phenomenon termed "necking" is developed as fracture ultimately occurs at the neck. Please use engineering stress-strain behavior to describe the processing stages of necking. (10%)
2. Several characteristics of dislocations are important with regard to the mechanical properties of metals. These include strain fields that exist around dislocations, which are influential in determining mobility of the dislocations, as well as their ability to multiply. Please explain why strain fields in a deformed metal are influential in mechanical properties? (10%) What kinds of mechanical properties are highly impacted due to the multiplication of dislocations? (10%) Discuss the influential factors such as temperature and slip systems in a deformed metal? (10%)
3. Specific biocompatible coating is usually applied in many prosthetic devices such as implantable microelectrodes, joint prostheses, and in several electrosurgical tools. Please give an example of prosthetic devices or electrosurgical tools that one or several treatment methods are purposely considered? (20%)
4. There are four kinds of biological tissues: (a) Femur bone, (b) Cruciate ligaments, (c) Quadriceps tendon, and (d) Rectus femoris muscle. Please use *stress-strain curves* to describe their mechanical properties. (10%)
5. *Synthetic polymers* are now involved in many therapeutic system or devices. Basically, therapeutic application can be classified by the two aspects: (1) the prosthetic system or devices used as permanent aids to replace tissues or organs definitely destroyed because of disease or trauma or both; (2) as temporary aids required for a limited time, i.e. the healing time. The second aspect has been recognized as an important area in biodegradable materials, why? (10%) Give two bioresorbable "*applications*" of synthetic polymers in therapy. (10%)