**Grand Assignment**

**Course Title: Biomechanics And Ergonomics I**

**DPT 2nd semester section B**

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**Department: DPT ( sec b)**

**Assignment: biomechanics**

**Marks: 20**

**Note:**

**INTERNAL ASSESSMENT MARKS WILL BE GIVEN ON BASIS OF GRAND ASSIGNMENT**

**Q1:** Explain “Biomechanics of Articular cartilage”

**Q2:** Explain “Biomechanics of Tendon and Ligament”

ALL THE STUDENTS ARE REQUESTED TO UPLOAD YOUR ASSINGMENT BEFORE FINAL TERM EXAM.

Q.1:

Ans: BIOMECHANICS OF ARTICULAR CARTILAGE:

Introduction;

* Articular cartilage is found in synovial joint
* Articular cartilage function;
  + Increasing load distribution
  + Allow movement while reducing function and wear

Wear of articular cartilage:

Is unwanted removal of material from solid surface by mechanical action. Can be:

* Interfacial wear: Bearing surface come into direct contact, with no lubricant film separating them.
* Fatigue wear: Accumulation of microscopic damage within the bearing material under repetitive stressing.
* Wear due to synovial joint impact loading.

Biomechanical behavior of articular cartilage:

* Intrinsic material properties and resistance to flow of solid matrix define interstitial fluid pressurization.
* Interstitial fluid pressurization influences :
* - load-bearing capacity
* Lubricant capacity

Lubricant of articular cartilage:

* Articular cartilage not perfectly smooth; asperities
* Fluid film lubricant in regions of cartilage non-contact
* Boundary lubricant (lubricin) in areas of asperities.
* Low rate of interfacial wear suggest that asperities contact rarely occurs in articular cartilage

Function of cartilage:

* Due to ECM, it allows the tissue to bear mechanical stress
* In respiratory tracts, ears, nose, cartilage forms framework supporting soft tissue
* Cartilage provide shock absorbing and sliding regions with in joints and facilitate bone movement due to smooth lubricant surface and resiliency.

Q.2:

And: Biomechanics of tendons and ligaments:

Introduction:. Tendons: tendons connect muscles to bone.

* Tendons consist of bundle of collagenous fibers arrange in parallel. They are arranged this way to form cords which have great tensile strength.
* Origins at muscle, crosses at least one joint and insert in bone.

Ligaments: ligaments connect bone to bone

* Ligaments consist mostly of bundles of elastin molecules formed into elastic fiber with some bundle of collagen.
* Origins and insert in bone.
* More elastic and flexible than tendons.
* Offer less tensile strength.

Tendons and ligaments are connective tissue that serve as the force transmitting entities and enable musculocutaneous motion. Typical features of normal tendon tissue are parallel-aligned collagen 1 fibres and tenocytes. Moreover, the extracellular matrix is composed of proteoglycan, glycoproteins and elastin.

Anatomical position of tendons

TENDONS

Anatomy:

* Tendons contain collagen fibrils ( type 1)
* Tendons contain a proteoglycan matrix
* Tendons contain fibroblasts (biological cells) that are arranged in parallel rows

Type 1 collage

* -86% of tendons dry weight
* Glycerin (-33%)
* Purloin (-15%)
* Hydroxyproline ( -15% almost unique to collagen, often used to identify)

Anatomical position of ligaments

LIGAMENTS

Anatomy

* Similar to tendons in hierarchical structure.
* Collagen fibrils are slightly less in volume fraction and organization than tendons
* Higher percentage of proteoglycan matrix than tendon.
* Fibroblasts

FUNCTIONS

Tendons

1. Tendons carry tensile forces from muscle to bone.
2. They carry compressive forces when wrapped around bone like a pulley.
3. They facilitate skeletal muscle movement ( movement in joints)
4. Proprioception
5. Secondary function: storage of energy.

Ligaments

1. It maintains correct bone and joint geometry.
2. Ligaments + associated joints capsules combinely function as passive joint stabilizer.
3. Secondary function: proprioception.