

BTY730:BIOMECHANICS

L:3 T:0 P:0 Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: study the structure and functions of skeletal muscle, bone structure & composition

CO2 :: review the properties of bone, applied forces and deformations in context to biomedical engineering

CO3 :: relate principles of mechanics, stress and strain, structure of skeletal muscle by observing movement in human body

CO4 :: analyze the structure of skeletal muscle-fiber types and shoulder for investigation of complex problems

CO5 :: evaluate the movement applied to different joints for problem analysis and properties of blood

CO6 :: structure the concepts of fluid mechanics and loads to different joints to develop solutions of biomedical problems

Unit I

Fundamentals of mechanics : Newton's Laws, mechanical behavior of bodies in contact, work, power and energy relationship, basic concepts of Force Moments and Torque, equilibrium, analysis of systems in equilibrium, skeletal joints, skeletal muscle, mechanics of the elbow, shoulder, spinal column, hip, knee and ankle, center of gravity, stability and balance

Unit II

Bone and cartilage : bone structure & composition, blood circulation in bone, mechanical properties of bone, viscoelastic properties of bone, Maxwell & Voight models, viscoelastic properties of articular cartilage, anisotropy and composite models for bone, bone response to stress, Osteoporosis – causes, diagnosis, treatment

Unit III

Stress and strain : applied forces and deformations, stress and strain, basic loading configurations, uniaxial tension test, load- elongation diagrams, Hooke's law, properties based on stress-strain diagrams, idealized model for material behavior and mechanical properties of materials

Unit IV

Mechanics of skeletal muscle : structure of skeletal muscle, muscle fibers, motor units, structure of skeletal muscle-fiber types, fiber architecture, sliding element theory of skeletal muscle, skeletal muscle function, contraction of skeletal muscle and hill's three element model

Unit V

Mechanics of shoulder, spine and hip : structure of the shoulder, movements of shoulder complex, loads on the shoulder, structure of the spine, movements of the spine, muscles and loads on the spine, structure and movements of the hip, loads on the hip

Unit VI

Biofluidic mechanics : Newtonian viscous fluid, non viscous fluid, rheological properties of blood, structure and composition of blood vessels, remodeling of blood vessels, nature of fluids, propulsion in fluid medium, mechanical properties of arterioles, capillary vessels and veins

Text Books:

1. FUNDAMENTALS OF BIOMECHANICS by NIHAT O' ZKAYA • MARGARETA NORDIN DAVID GOLDSHEYDER • DAWN LEGER, SPRINGER

References:

1. BASIC BIOMECHANICS by SUSAN J HALL, Tata McGraw Hill, India

