BT 641 FUNDAMENTALS OF HUMAN BODY MECHANICS (3-0-0-6)

Preamble:

Human Body Mechanics (also known as Biomechanics) is the study of the effect of external forces on the human body. This course will introduce students to the principles of Mechanics that can be applied to human structure and function, thereby allowing analysis of human movement and the musculoskeletal system. The primary objective of this subject is to provide a background in musculoskeletal anatomy and principles of biomechanics. The course applies and builds on the concepts of Statics and, Dynamics for human activities, and Mechanics of Materials and Tissues. An awareness of the Mechanics of tissues in the musculoskeletal system will be introduced as applied to exercise prescription and injury. The theoretical basis of methods for assessing movement, both quantitative and qualitative, will also be introduced enabling practical analysis of common movements to be performed. Finally, popular joint replacement techniques will be introduced and the basic approach for implant design will be discussed.

Course contents:

Introduction to Biomechanics: Terminology, Anthropometry and Concept of human musculoskeletal system, types of movement. Biomechanics of tissues and structures of musculoskeletal system – composition, structure and biomechanical behaviour: bone, articular cartilage, muscle, tendon and ligament.; joint mechanics – structure, range of motions, musculoskeletal model of forces: (i) hip; (ii) knee; (iii) shoulder; (iv) elbow; (v) spine. Lubrication of joints. Motion and gait analysis – method, human gait cycle, segmental kinetics, engineering approaches to posture analysis. Characterizing elastic anisotropy of bone – modelling and remodelling of bones - Wolfe's law of bone remodelling - Effect of stress shielding. Joint replacement and fracture fixation – stress analysis and failure mechanisms, basic design approach of implants – design conflicts and trade-offs, wear in joint arthroplasty, Viscoelasticity of soft tissues – Models of viscoelasticity (Maxwell, Voigt, Kelvin).

Annexure-130/10(c) contd…..

Texts/References:

1. R. L. Huston, *Principles of Biomechanics*, CRC Press, 2008.
2. D. Knudson, *Fundamentals of Biomechanics*, 2nd Edn.,Springer, 2007.
3. M. Nordin and V.H. Frankel, *Basic Biomechanics of the Musculoskeletal System*, Lippincott Williams & Wilkins, 2011.
4. S. McCaw, *Biomechanics for dummies*, Wiley, 2014.
5. D.L. Bartel, D.T. Davy and T.M. Keaveny, *Orthopaedic Biomechanics: Mechanics and Design in Musculoskeletal Systems*, Pearson, 2006.
6. N. Özkaya, M. Nordin, D. Goldsheyder and D. Leger, *Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation*, 4th Edn., Springer, 2017.
7. Y.C. Fung, *Biomechanics: Mechanical Properties of Living Tissues*, 2nd Edn., Springer, 1993