

| BIOMECHANICS         |                            |
|----------------------|----------------------------|
| Subject Title        | : BIOMECHANICS             |
| Duration             | : 0 – 12 Months            |
| Total Hours          | : 180                      |
| Theory               | : 90 Hours                 |
| Practical            | : 90 Hours                 |
| Total Hours / Week   | : 6 Hrs                    |
| Lecture              | : 2 Hours / Week           |
| Practicals           | : 3 Hours / Week           |
| Seminars / Tutorials | : 1 Hour / Week            |
| Method of Assessment | : Written, Oral, Practical |

### Course Description

Biomechanics involves the study of basic concepts of human movement, and application of various biomechanical principles in the evaluation and treatment of disorders of Musculoskeletal system. Students are taught to understand the various quantitative methods of movement. Mechanical principles of various treatment methods are studied. Study of posture and gait are also included.

### THEORY

#### 1. Basic Concepts in Biomechanics: Kinematics and Kinetics [3 Hours]

- a) Types of Motion
- b) Location of Motion
- c) Direction of Motion
- d) Magnitude of Motion
- e) Definition of Forces
- f) Force of Gravity
- g) Reaction forces
- h) Equilibrium
- i) Objects in Motion
- j) Force of friction
- k) Concurrent force systems
- l) Parallel force systems
- m) Work



- n) Moment arm of force
  - o) Force components
  - p) Equilibrium of levers
2. Joint structure and Function [ 3 Hours]
- a) Joint design
  - b) Materials used in human joints
  - c) General properties of connective tissues
  - d) Human joint design
  - e) Joint function
  - f) Joint motion
  - g) General effects of disease, injury and immobilization.
3. Muscle structure and function [ 3 Hours]
- a) Mobility and stability functions of muscles
  - b) Elements of muscle structure
  - c) Muscle function
  - d) Effects of immobilization, injury and aging
4. Biomechanics of the Thorax and Chest wall[ 4 Hrs] ✓
- a) General structure and function
  - b) Rib cage and the muscles associated with the rib cage
  - c) Ventilatory motions: its coordination and integration
  - d) Developmental aspects of structure and function
  - e) Changes in normal structure and function I relation to pregnancy, scoliosis and COPD
5. The Temporomandibular Joint [ 4 Hours]
- a) General features, structure , function and dysfunction
6. Biomechanics of the vertebral column [10 Hours] ✓
- a) General structure and function
  - b) Regional structure and function – Cervical region, thoracic region, lumbar region, sacral region
  - c) Muscles of the vertebral column
  - d) General effects of injury and aging
7. Biomechanics of the peripheral joints [ 54 Hours] ✓
- a) The shoulder complex: Structure and components of the shoulder complex and their integrated function
  - b) The elbow complex: Structure and function of the elbow joint – humeroulnar and humeroradial articulations, superior and inferior radioulnar joints; mobility and stability of the elbow complex; the effects of immobilization and injury.
  - c) The wrist and hand complex: Structural components and functions of the wrist complex; structure of the hand complex; prehension; functional position of the the wrist and hand.



- d) ✓ The hip complex: structure and function of the hip joint; hip joint pathology- arthrosis, fracture, bony abnormalities of the femur:
  - e) ✓ The knee complex: structure and function of the knee joint – tibiofemoral joint and patellofemoral joint; effects of injury and disease.
  - f) ✓ The ankle and foot complex.: structure and function of the ankle joint, subtalar joint, talocalcaneonavicular joint, transverse tarsal joint, tarsometatarsal joints, metatarsophalangeal joints, interphalangeal joints, structure and function of the plantar arches, muscles of the ankle and foot, deviations from normal structure and function – Pes Planus and Pes Cavus
8. ✓ Analysis of Posture and Gait [9 Hours] : Static and dynamic posture, postural control, kinetics and kinematics of posture, ideal posture analysis of posture, effects of posture on age, pregnancy, occupation and recreation; general features of gait, gait initiation, kinematics and kinetics of gait, energy requirements, kinematics and kinetics of the trunk and upper extremities in relation to gait, stair case climbing and running, effects of age, gender, assistive devices, disease, muscle weakness, paralysis, asymmetries of the lower extremities, injuries and malalignments in gait; Movement Analysis : ADL activities like sitting – to standing, lifting, various grips , pinches.

PRACTICAL: [90 Hours] shall be conducted for various joint movements and analysis of the same. Demonstration may also be given as how to analyze posture and gait.

The student shall be taught and demonstrated to analysis for activities of daily living – ADL – (like sitting to standing, throwing, lifting etc.) The student should be able to explain and demonstrate the movements occurring at the joints, the muscles involved, the movements or muscle action produced, and mention the axis and planes through which the movements occur. The demonstrations may be done on models or skeleton.

#### ***Recommended Text books :***

1. *Joint Structure and Function – A comprehensive Analysis*, JP Bros Medical Publishers, New Delhi.
2. *Brunnstrom, Clinical Kinesiology*, JP Bros Medical Publishers, Bangalore, 5<sup>th</sup> Ed 1996, 1<sup>st</sup> Indian Ed 1998, Rs 250.00
3. *Clinical Kinesiology for Physical Therapist Assistants*, JP Bros Medical Publishers, Bangalore, 1<sup>st</sup> Indian Ed 1997, Rs 300.00