

**Second B.O.Th. Year**  
**204. Biomechanics & Kinesiology**

Total hours: 260 (Theory -100, Practical —160)

Total marks: 200 marks

Theory: 100 marks (Final exams: 70 marks, Internal Assessment: 30 marks)

Practicals: 100 marks (Final exams: 70 Marks, Internal Assessment —30 marks)

**COURSE OBJECTIVES:**

The students will be able to fulfill with 75% accuracy the following objective of the course

**Theory -**

- 1) Describe general concepts of biomechanics. Explain essential terms & concepts in biomechanics : classification of mechanics — static, dynamic, kinematics, kinetic.
- 2) Kinetics — Define force. Describe Newton's laws of motion with examples & application in Occupational therapy. Classify linear, parallel, concurrent & general force system. Describe composition and resolution of forces with examples. Explain moment, torque & couple. Enumerate types of forces & their examples. Explain moment torque & couple. Enumerate types of forces & their characteristics. Describe centre of gravity & its application in human body, planes of human body. Classify levers and explain physiological significance of trade — off of mechanical advantage. Describe static and dynamic equilibrium with examples. Describe friction and its practical application in the human body. Application of kinetics in occupational therapy.
- 3) Explain the concepts of kinematics & types of motion — linear *I* translatory, rotatory *I* angular, curvilinear, general plane motion. Application of kinematics in human body- open & close kinematic chain motion. –
- 4) Describe biomechanics of upper extremity joints — Shoulder, elbow, radio-ulnar, wrist, hand with special emphasis on articular surfaces, joint capsule, type of joint, muscles and ligaments surrounding the joint, their action & functions, forces applied, movements occurring relationship of joints to other joints.
- 5) Describe biomechanics of lower extremity joints Hip. Knee. Ankle and sub-talar joints with special emphasis on articular surfaces, joint capsule, type of joint, muscles and ligaments surrounding the joint, their action and functions, forces applied movements, occurring, relationship of joints to other joints. In addition explain arus & valgus of femoral neck, forces acting during single and double leg stande, factors affecting, effect of use of cane on hip joint forces Describe

stability & mobility with respect to locking and unlocking of knee and patellofemoral joint.  
Explain stability achieved at ankle and sub-talar joints, arches of foot, weight bearing on foot

- 6) Briefly explain the normal human gait cycle, its parameters, myokinetics and kinematics, stair gait, running, common gait deviations, types of crutch and cane, crutch and cane gaits.
- 7) Explain the anatomical aspects of posture, factors affecting posture, Normal and abnormal curvatures of spine, exercises for spine.
- 8) Define vicarious movements, explain types with examples and describe the same in various nerve injuries.
- 9) Explain principles of range of motion testing in clinical conditions — indications and contraindications, visual observation
- 10) Explain principles of individual muscle testing in clinical conditions.

### **PRACTICALS:**

- 1) Acquire the skill of assessment of range of motion of joints of U.E., L.E. & spine on patients. (60 hrs)
- 2) Acquire the skill of assessment of isolated muscle strength in U.E. & L.E., testing spinal muscle groups on patients (70 hrs)
- 3) Demonstrate types of crutch gait, identify & analyze pathological gaits (30 hrs)

### **COURSE CONTENTS**

- 1) General concepts of biomechanics: (05 hrs)
  - a) Essential terms & concepts in biomechanics : classification of mechanics — static, dynamic, kinematics, kinetic.
- 2) Kinetics: (15 hrs)
  - a) Force: Definition
  - b) Newton's laws of motion with examples and application in O.T
  - c) Classification of force system — linear, parallel, concurrent, general, composition and resolution of forces with examples. Moment torque & couple.
  - d) Types of forces- internal, external, gravity- centre of gravity and its

- application in human body, planes of human body.
- e) Levers — classification, physiological significance of trade — off of mechanical advantage
  - f) Static and dynamic equilibrium with examples.
  - g) Friction and its practical application in the human body
  - h) Application in occupational therapy.
- 3) Kinematics : Types of motion — linear / translator, rotatory / angular, curvilinear, general plane motion. Application of kinematics in human body — open & close kinematics chain motion (5 hrs)
  - 4) Biomechanics of upper extremity joints: (25 hrs)  
Shoulder, elbow, radio-ulnar, wrist, hand with special emphasis on particular surfaces, joint capsule, type of joint, muscles and ligaments surrounding the joint, their action & functions, forces applied, movements occurring, relationship of joints to other joints.
  - 5) Biomechanics of lower extremity joints (25 hrs)  
With special emphasis on articular surfaces, joint capsule type of joint, muscles, and ligaments surrounding the joint, their action & functions,, forces applied, movements occurring, relationship of joints to other joints. In addition to following:
    - a) Hip — Varus & valgus of femoral neck, forces acting during single & double leg stance, factors affecting, effect of use of cane on hip joint forces.
    - b) Knee & patellar-femoral — Stability & mobility with respect to locking and unlocking of joint.
    - c) Ankle & sub-talar joints — Stability achieved, arches of foot, weight bearing on foot.
  - 6) Gait: (10 hrs)  
Normal human gait cycle (walking), its parameters, myokinetics & kinematics, stair gait, running. Common gait deviations. Types of crutch & cane, crutch & cane gaits. preparatory exercises for crutch cane walking.
  - 7) Posture: (5 hrs)  
Anatomical aspects of posture, factors affecting posture. Normal & abnormal curvatures of spine, exercises for spine.
  - 8) Vicarious movements: types with examples, in various nerve injuries ( 5 hrs)
  - 9) Range of motion testing: Principles in clinical conditions — indications and contraindications, visual observations (2 hrs)
  - 10) Muscle strength — individual muscle testing: Principles in clinical conditions (3hrs)

### **BOOKS RECOMMENDED**

Occupational Therapy: Practice skills for Physical Dysfunction by L.V. Pedretti  
Occupational Therapy for Physical Dysfunction by C.A. Trombly.

Joint Structure and Function — A Comprehensive Analysis by C.C. Norring, P.K. Levangie,  
Physiology of joint & joint motion by Kapanji L A.  
Therapeutic exercise by J. Basmajian  
Biomechanics of human motion by William Listner  
Measurement of joint motion : a guide to goniometry by C.C. Norring & D.J. White  
Therapeutic exercise — Foundations and Techniques — C. Kisner. L. A. & Colby  
Occupational Therapy & physical dysfunction A. Turner  
Muscle testing and function by F.P. Kendall  
Daniel's & Worthingham's Muscle testing.