

Biomechanics Lesson Plan 2023-2024

MONTH OF JANUARY

1.INTRODUCTION AND BIOMECHANICAL FOUNDATIONAL CONCEPTS

Objectives:

At the end of this chapter students will be able to,

- Define and state the principles of biomechanics and its subdivisions.
- List all the types of motion and give examples.
- List the forces applied on the body.
- Application of Newton's laws to movements of body segments
- Verbalize levers and identify the orders of levers in the human body and discuss its advantages and disadvantages.
- Verbalize pulleys present in the human body and its uses.

1. Basic Concepts in Biomechanics: Kinematics and Kinetics [Theory-5 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) Levers
- n) Pulleys
- o) Work
- p) Moment arm of force
- q) Force components
- r) Equilibrium of levers

Venue: LH2

Faculty : Naresh

Pg:Jomon

Ref: joint structure and function

Cynthia c norkin 5th ed, PN:4-10.

2. Joint structure and Function [Theory-6Hours]

Objectives:

At the end of this chapter students will be able to

- List the connective tissue with its properties.
- Discuss stress strain curve with its significance to physiotherapy.
- Classify the joints with examples.
- Differentiate kinetics and kinematics.

- a) Joint design
- b) Materials used in human joints
- c) General properties of connective tissues
- d) Joint function
- e) Joint motion

Faculty : Naresh

Pg:Jomon

Venue: LH2

Ref: joint structure and function Norkin 5thed –65-87

3. Muscle structure and function [Theory-3 Hours]

Objectives:

At the end of this chapter students will be able to

-Describe basic structure of the muscle and its functions with respect to mobility and stability.

-identify type of muscle contraction and should be able to demonstrate the same

-Differentiate passive and active insufficiency.

a) Mobility and stability functions of muscles

b) Elements of muscle structure

c) Muscle function

Faculty : Naresh

Pg:Jomon

Venue: LH2

Ref: joint structure and function

Cynthia Norkin 5thed –46-61

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN: 46-64

MONTH OF FEBRUARY

Faculty: Mohini

Pg: Sradha

Venue: LH1

Objectives :

At the end of this chapter, students will be able to

- Demonstrate pump handle and bucket handle movements
- List the changes specific to the disease.
- Name muscle of ventilation.

1. Biomechanics of the Thorax and Chest wall [3Hrs] (T)

- a) General structure and function
- b) Rib cage movements and
- c) The muscles associated with the rib cage
- d) General effects of injury and aging

CLINICAL APPLICATION (give activities like swimming, holding your breath, dyspnoea etc) (3 hours)

Theory + practical – total 6 hours

Ref: joint structure and function

Cynthia Norkin 5thed –193-208

2. biomechanics of temporomandibular joint (theory, 2 hrs)

Objectives :

At the end of this chapter students will be able to

- Name articular structures and joint movements
- Verbalize the muscles involved.

Faculty: Mohini

Movement analysis (3 hours) (PG -Vaishnavi)

Ref: joint structure and function

Cynthia Norikin 5thed –212-223

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN: 439-444

MODULE -3 SPINE AND VERTEBRAL COLUMN

Objectives :

-At the end of this chapter students will be able to

-Name the regions of vertebral column.

-Identify the cervical, Thoracic and lumbar vertebrae.

-Describe the structure of individual vertebrae and relate to the function

-Describe the factors contributing to stability and instability of spine,

-Biomechanical contributions to common injuries of the spine

-Review the normal kinematics of vertebral column

-Explain the relationship between the muscle location and nature and effectiveness of muscle action in the spine

-Describe the movement relationship between the pelvis and the lumbar vertebra

3. Biomechanics of the vertebral column (theory 6 hours)

General structure and function

- a. Regional structure and function – Cervical region, thoracic region, lumbar region, sacral region
- b. Muscles of the vertebral column
- c. Ligaments of Vertebral Column

Faculty: Vijay

PG: Rakshith

Venue: LH1

CLINICAL APPLICATION: BACK PAIN, LIFTING, WALKING WITH BACK PACK, WALKING WITH FRONT PACK, CARRYING WEIGHTS ON ONE SIDE, CARRYING WEIGHT ON 2 SIDES. (4 HOURS)

Ref: joint structure and function

Cynthia Norkin 5th ed –154-188

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN: 473-600

MONTH OF MARCH

1. Biomechanics of the peripheral joints (to include kinetics and kinematics, spatial, temporal, energetics)(56 hours)

SHOULDER COMPLEX

(Theory- 4 hours, clinical application 5 hours, total 9 hours)

- a) The shoulder complex: Structure and components of the shoulder complex and their integrated function.

Objectives :

At the end of this chapter students will be able to:

- Identify various joints of shoulder complex.
- Demonstrate movements of shoulder complex.
- Explain Glenohumeral rhythm.
- Explain static and dynamic stability of shoulder joint.
- Discuss osteokinematics and arthrokinematics of shoulder joint with its clinical applications.
- List all muscles around shoulder complex with its attachments and Function

Faculty: Kalashree

PG:Albun

Venue: LH-1

Ref: joint structure and function

Cynthia Norkin 5thed –232-267

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN: 121-146

ELBOW COMPLEX

Objectives:

At the end of this module students will be able to

- Describe articular surface of elbow and radio ulnar joints
- Demonstrate movements of elbow complex with muscle action
- Discuss osteokinematics and arthrokinematics of elbow joint with its clinical applications.

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.

Faculty: Mukund

Pg: Ronika

Venue:LH1

(Theory- 4 hours, clinical application 5 hours, total 9 hours)

Ref: joint structure and function

Cynthia Norkin 5thed –272-285

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN: 198-216

MONTH OF APRIL

WRIST AND HAND COMPLEX

Objectives:

At the end of this module students will be able to

- Identify various bones and joints around wrist and hand complex with a neat diagram.
- List the ligaments of wrist with its function.
- Explain flexor and extensor mechanism and its clinical applications.
- Explain various types of Prehension with examples
- Discuss osteokinematics and arthrokinematics of wrist joint with its clinical applications.

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.

Faculty: Mukund

PG: Deekshitha

Venue: LH1

T(4 hours, clinical application 5 hours, total 9 hours)

Ref: joint structure and function

Cynthia Norkin 5thed –306-348

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN: 198-216

Hand-Brunstrom's clinical kinesiology, 5th ed. Smith(213-320)

HIP COMPLEX

T(4 hours, clinical application 5 hours, total 9 hours)

d) The hip complex: structure and function of the hip joint.

Objectives:

At the end of the module student will be able to

-Understand and explain the structure and function of hip complex.

-Discuss osteokinematics and arthrokinematics of hip joint with its clinical applications.

-Identify muscle action during unilateral & bilateral stance

Explain the concept of using cane ipsilateral and contra lateral to the injured limb.

-Calculate the weight distribution to the lower extremity during unilateral stance, bilateral stance and while use of cane ipsilateral and contralateral.

Faculty: Mukund

PG: Jerom

Venue: LH1

Ref: joint structure and function

Cynthia Norkin 5thed –355-384

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN: 198-216

MONTH OF MAY

KNEE COMPLEX

T(4 hours, clinical application 5 hours, total 9 hours)

e) The knee complex: structure and function of the knee joint – tibiofemoral joint and patellofemoral joint.

- Understand and identify various joints of knee complex with its structure and function.
- Explain the actions of muscles around knee complex.
- Discuss osteokinematics and arthrokinematics of knee joint with its clinical applications.
- Discuss the concept of locking and unlocking of knee joint in open chain and closed chain with its clinical applications.
- Identify ligaments, Menisci and bursas of knee complex with its attachment and function

Faculty:Mukund

PG: Avyash

Venue:LH1

Ref: joint structure and function

Cynthia Norkin 5thed –412-435

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN: 759-762.

THE FOOT COMPLEX

(Theory-4 hours, clinical application 5 hours, total 9 hours)

Objectives: At the end of the module students will be able to

- Identify bones and joints of the ankle and foot complex.
- Identify movements of the ankle and foot complex with its axis and planes.
- List various muscles that act on the ankle and foot with their attachments and action.
- List the ligaments of the ankle complex with their functions.
- Discuss osteokinematics and arthrokinematics of ankle and foot complex

Discuss arches of foot and its abnormalities with its clinical applications.

Discuss the Supination and Pronation twist and metatarsal break.

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.

Faculty: Boomika

PG: Samhitha

Venue: LH1

Ref: joint structure and function

Cynthia Norkin 5thed –441-471

The mechanics and Patho mechanics of human motion.

2nd ed Carol Oatis PN: 808-831.

Brunstrom's clinical kinesiology.5th ed

Smith P N: 544-556

MONTH OF JUNE

GAIT AND POSTURE

Objectives: At the end of the module student will be able to

- Describe the alignment of the body in erect standing posture and its variability
- Discuss the current understanding of the muscle needed to control erect standing
- Describe common postural faults
- Analyze the posture in sagittal ,frontal plane
- Describe the basic component of gait cycle
- Present the temporal and distance characteristics of normal gaitDescribe the pattern of muscle activity that characterize normal locomotion

1.Analysis of Posture and Gait [9 Hours] :

a) Static and dynamic posture, postural control, kinetics and kinematics of posture, ideal posture

analysis of posture,

b) 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.

2.Movement Analysis [2 hours] :

ADL activities like sitting – to standing, lifting, various grips pinches.

Faculty:naresh

Pg: Jomon

Venue: LH1

Ref: joint structure and function

Cynthia Norkin 5thed –483-524 & 523-558

The mechanics and Pathomechanics of human motion.

2nd ed Carol Oatis PN:875-889 &893-913

2.Goniometry [2 hours]:

Parts types, principles and uses of a goniometry. Techniques for measurement of ROM of all peripheral joints.

Faculty: Kalashree

Pg: varsha

Venue : Biomechanics/exercise therapy lab

Ref: Measurement of joint- A Guide to goniometry

Cynthia norkin

4. Walking Aids[1 hour]:

Parallel bars, crutches, canes, walkers – types, parts and uses.

Ref: Physical rehabilitation- 5th edition-Susan O Sullivan-PN: 523-560

The following topics are part of applied Biomechanics and are required to be taught but not for examination.

- a) General effects of disease, injury and immobilization.
- b) Effects of immobilization, injury and aging
- c) Changes in normal structure and function I relation to pregnancy, scoliosis and COPD
- d) Effects of posture on age, pregnancy, occupation and recreation;

faculty: vijay

pg: Jomon

Venue: LH 1

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, 5th Ed 1996, 1st Indian Ed 1998,
3. Clinical Kinesiology for Physical Therapist Assistants, JP Bros Medical Publishers, Bangalore, 1st Indian Ed 1997

Reference book available in the library

1	Measurement of joint motion a guide to goniometry	Cynthia c Norkin
2	Joint structure and function	Cynthia c Norkin
3	The physiology of joint Vol I+ Vol II + Vol III	Kapandiji IA
4	Basic biomechanics	Susan J Hall
5	Biomechanical basic of human movement	Joseph Hamill
6	The physiology of joint Vol I (Upper limb)+ Vol II(Lower limb) + Vol III (Trunk and Vertebral Column)	Kapandiji IA
7	Biomechanics of musculo skeletal injury	William C Whiting
8	Biomechanics of Sports and Exercise	Peter mc ginnis
9	Understanding joints a practical guide to their structure and function	Bernard Kingston
10	Understanding joints a practical guide to muscle function	Bernard Kingston
11	Biomechanics in physical education and exercise science	Uppal AK
12	Joint motion clinical measurement and evaluation	Soames roger
13	The bio physical foundation of human movement	Abernethy Bruce
14	Bones and joints a guide for students	Gunn Christine
15	Clinical kinesiology for Physical therapist	Lippert , lynn S
16	Joint structure and function	Levangie Pamela norkin
17	Basic biomechanics of the musculoskeletal system	Nordin, margareta

