

AmbujaNeotia



**THE NEOTIA
UNIVERSITY**

ज्ञानम् आत्म प्रदीपाय

UGC Enlisted & Recognised

**Department of Physiotherapy
School of Health Science**

Bachelor of Physiotherapy

(BPT)

***Biomechanics & Kinesiology II
Practical Manual***

Course Code: BPT 471

Index

Sl.no.	Topic	Page no.
01.	General Procedur	05
02.	Muscle Action Laboratory	06
03.	Muscular Analysis Procedures	06
04.	Movement Terminology & Body Mechanics	07
05.	Hip Joint	08
06.	Knee Joint	10
07.	Ankle Joint	11
08.	Movement Analysis of Lower limb joints	13
09.	Hip Joint	14
10.	Knee Joint	18
11.	Ankle Joint	22
12.	Gait Analysis	27
13	Visual Gait Analysis	37
14.		

Certificate

This is to certify that Mr./Ms. with
UID number of Bachelor of
Physiotherapy Semester 4th has satisfactorily completed the practical prescribed by
the Neotia University for the year

.....
Signature of Student

.....
Signature of Faculty

Date of Submission:

General Procedures

Muscle Action Laboratory

Step 1: Use the bones, muscle models, and muscle diagrams to help you study these muscles and their attachments and actions.

Step 2: Record the summary of articulations, degree of freedom and muscle actions.

Step 3: Identify the line of pull and torque responsible for the movement of the joint.

Muscular Analysis Procedures

Step 1: Identify the muscles that are developing tension in order to cause or control movement of a body part. The following steps should be taken for each joint of interest:

- a) Make a list of all the actions that occur at each joint in the movement.
- b) Break the movement into phases where only one movement per plane is occurring.
- c) Determine what type of muscle action is occurring during each phase at each joint.
- d) Make a list of all the muscles that might belong to the functional muscle group developing force (agonists or antagonists) [i.e., all muscles that might be involved in causing (concentric) or controlling (eccentric) each joint action].
- e) Identify bones/joints that must be stabilized and list the muscles that must be employed as stabilizers.

Step 2: Performing a Muscular Analysis. Perform the following movements and complete the charts for the initial (movement from position 1 to 2) and return phase (movement from position 2 to 1) in each of the movements in the joint.

Movement Terminology & Body Mechanics

To review the various articulations of the human body, to familiarize the students with the movements possible at the lower limb joints, and to learn terminology used to describe human movement.

Define the following terms:

1. Sagittal Plane
2. Coronal Plane
3. Transverse Plane
4. Antero-posterior Axis
5. Transverse Axis
6. Longitudinal Axis

Process: Complete the questions on the following pages for the major moveable joints in the human body. Consider the body in anatomical position and the proximal segment of each joint fixed.

Hip Joint - Pelvis Fixed (move thigh at the hip joint)

1. Name the movements that occur in the sagittal plane.

2. Name the movements that occur in the frontal plane.

3. Name the movements that occur in the transverse plane.

4. Can circumduction be performed at this joint?

5. From a position of 90° of hip flexion (knee flexed to 90°), move the femur toward the midline of the body in the transverse plane about a longitudinal axis.

What is the name of this movement?

6. Move the femur away from the midline of the body in the transverse plane about a longitudinal axis. What is the name of this movement?

Knee Joint

1. Move the tibia and fibula in the sagittal plane.

Name of posterior movement? _____

Axis of movement? _____

2. With the knee flexed (as in a sitting position), rotate the tibia and fibula so that the anterior aspect of the leg turns medially and then laterally.

Name of medial movement? _____

Name of lateral movement? _____

Because the knee can perform movement in two planes, it is classified as a **biaxial** joint.

Ankle Joint (talocrural)

1. Move the foot in a sagittal plane.

Name the movement in which the
dorsal surface of the foot moves
toward the anterior aspect of the leg. _____

Name the movement in which the
dorsal surface of the foot moves away
from the anterior aspect of the leg. _____

Intertarsal Joints (subtalar, midtarsal)

1. Move the foot so that the sole faces medially. What is the name of this movement? _____

2. What is the name of the movement in the opposite direction, in which the sole is turned to face laterally? _____

***Movement Analysis
of
Lower limb joints***

Hip Joint

- Complete the chart below to perform a basic anatomical analysis for the movements given during practical classes.
- Analyze the movements by filling the chart:

Phase	Joint Action	Plane Associated with Joint Action	Axis Associated with Joint Action

- Do movement analysis based on the process described before.

- **Movement 1:**

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- **Movement 2:**

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- **Movement 3:**

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Knee Joint

- Complete the chart below to perform a basic anatomical analysis for the movements given during practical classes.
- Analyze the movements by filling the chart:

Phase	Joint Action	Plane Associated with Joint Action	Axis Associated with Joint Action

- Do movement analysis based on the process described before.

- **Movement 1:**

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- **Movement 2:**

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- **Movement 3:**

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Ankle Joint

- Complete the chart below to perform a basic anatomical analysis for the movements given during practical classes.
- Analyze the movements by filling the chart:

Phase	Joint Action	Plane Associated with Joint Action	Axis Associated with Joint Action

- Do movement analysis based on the process described before.

- **Movement 1:**

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- **Movement 2:**

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- **Movement 3:**

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Observational Gait Analysis

Gait Analysis

- It is important to be able to visualize the events of the normal gait cycle during walking or running. The gait cycle can be divided into different phases and subphases, so that each action of the foot and leg can be evaluated at specific sequential time periods.

Phases of Gait

- The gait cycle of each leg is divided into the stance phase and the swing phase. The stance phase is the period of time during which the foot is in contact with the ground. The swing phase is the period of time in which the foot is off the ground and swinging forward.
- An important point to note is that in running an added subphase is present. Float phase. During float phase, neither foot is on the ground.
- Analysis has to be done for both kinematics and kinetics.

Model 1:

Kinematics of Gait:

Measure and write the following:

- Cadence:
- Step length:
- Stride length:
- Width of Base of Support
- Position and angle of the following joints in each phase of gait

Stance Phase

- Heel strike
 1. Hip:
 2. Knee:
 3. Ankle:
- Loading Response
 1. Hip:
 2. Knee:
 3. Ankle:
- Mid-stance
 1. Hip:
 2. Knee:
 3. Ankle:
- Terminal stance
 1. Hip:
 2. Knee:
 3. Ankle:
- Pre-swing

1. Hip:
2. Knee:
3. Ankle:

Swing Phase

- Initial swing
 1. Hip:
 2. Knee:
 3. Ankle:
- Mid swing
 1. Hip:
 2. Knee:
 3. Ankle:
- Terminal swing
 1. Hip:
 2. Knee:
 3. Ankle:

Kinetics of Gait:

Muscle activity during different phases of gait:

1. Heel strike:
2. Foot flat:
3. Mid-stance:
4. Heel-off:
5. Toe-off:
6. Acceleration:
7. Mid-swing:
8. Deceleration:

Model 2:

Kinematics of Gait:

Measure and write the following:

- Cadence:
- Step length:
- Stride length:
- Width of Base of Support
- Position and angle of the following joints in each phase of gait

Stance Phase

- Heel strike
 1. Hip:
 2. Knee:
 3. Ankle:
- Loading Response
 1. Hip:
 2. Knee:
 3. Ankle:
- Mid-stance
 1. Hip:
 2. Knee:
 3. Ankle:
- Terminal stance
 1. Hip:
 2. Knee:
 3. Ankle:
- Pre-swing
 1. Hip:

2. Knee:
3. Ankle:

Swing Phase

- Initial swing
 1. Hip:
 2. Knee:
 3. Ankle:
- Mid swing
 1. Hip:
 2. Knee:
 3. Ankle:
- Terminal swing
 1. Hip:
 2. Knee:
 3. Ankle:

Kinetics of Gait:

Muscle activity during different phases of gait:

1. Heel strike:

2. Foot flat:

3. Mid-stance:

4. Heel-off:

5. Toe-off:

6. Acceleration:

7. Mid-swing:

8. Deceleration:

Model 3:

Kinematics of Gait:

Measure and write the following:

- Cadence:
- Step length:
- Stride length:
- Width of Base of Support
- Position and angle of the following joints in each phase of gait

Stance Phase

- Heel strike
 1. Hip:
 2. Knee:
 3. Ankle:
- Loading Response
 1. Hip:
 2. Knee:
 3. Ankle:
- Mid-stance
 1. Hip:
 2. Knee:
 3. Ankle:
- Terminal stance
 1. Hip:
 2. Knee:

3. Ankle:

- Pre-swing

1. Hip:

2. Knee:

3. Ankle:

Swing Phase

- Initial swing

1. Hip:

2. Knee:

3. Ankle:

- Mid swing

1. Hip:

2. Knee:

3. Ankle:

- Terminal swing

1. Hip:

2. Knee:

3. Ankle:

Kinetics of Gait:

Muscle activity during different phases of gait:

1. Heel strike:

2. Foot flat:

3. Mid-stance:

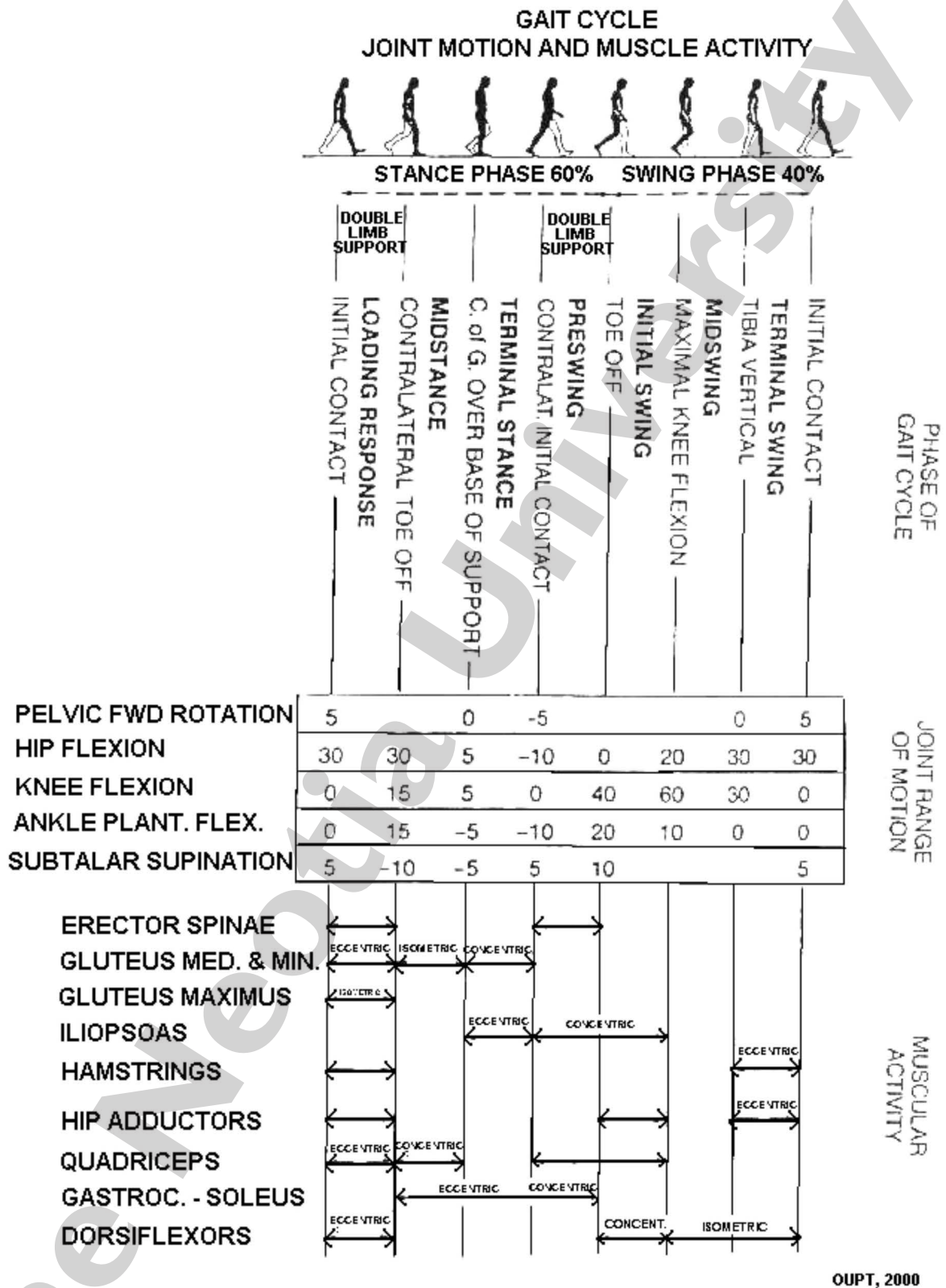
4. Heel-off:

5. Toe-off:

6. Acceleration:

7. Mid-swing:

8. Deceleration:



*An example of visual gait analysis is given above.

CLASSIC GAIT
TERMINOLOGY:

	Heel Strike	Foot Flat	Midstance	Heel Off	Toe-Off	Acceleration	Midswing	Deceleration
Rancho Los Amigos Terms NEW TERMINOLOGY	INITIAL CONTACT	LOADING RESPONSE	MID STANCE	TERMINAL STANCE	PRE-SWING	INITIAL SWING	MID SWING	TERMINAL SWING
	STANCE PHASE 60%					SWING PHASE 40%		
% OF TOTAL PHASE	0-2%	0-10%	10-30%	30-50%	50-60%	60-73%	73-87%	87-100%
ILIOPSOAS	inactive	inactive	inactive	concentric	concentric	concentric	concentric	inactive
GLUTEUS MAXIMUS	eccentric	inactive	inactive	inactive	inactive	inactive	inactive	inactive
GLUTEUS MEDIUS	eccentric	eccentric	eccentric	eccentric	inactive	inactive	inactive	inactive
HAMSTRINGS	eccentric	eccentric	inactive	inactive	inactive	eccentric	eccentric	eccentric
QUADRICEPS	eccentric	eccentric	inactive	inactive	eccentric	eccentric	inactive	inactive
PRETIBIAL MUSCLES	eccentric	eccentric	inactive	inactive	inactive	concentric	concentric	concentric
CALF MUSCLES	inactive	inactive	eccentric	concentric	concentric	inactive	inactive	inactive

KEY:

INACTIVE

CONCENTRIC

ECCENTRIC

*Muscles involved in the gait.

Breakdown of the Gait Cycle

Answer the following questions:

1. What bony structures and joints are involved in the gait cycle? Primary and secondary?
2. What are the 2 phases of the gait cycle? Explain each in detail.
3. Explain Q angle.
4. How does running change the gait pattern?
5. How does speed impact the phases of the gait cycle?
6. How does running change the force acting on the body?
7. Explain the subphases of the stance phase.
8. Which phase is crucial to propulsion? Why?
9. Which phase lasts the longest in the stance phase?
10. How will structural abnormalities affect the propulsion phase?
11. When does the swing phase begin? Explain its steps.
12. What is double support? When does it occur?
13. What is the pre-swing?
14. How is the propulsion phase divided?
15. How does arm swing affect a runner?
16. What is the difference in rotation between femur and tibia?
17. Explain the impact the posterior tibialis muscle has on the contact and midstance phases.
18. How is neutral position determined in the foot?
19. What is the difference in calcaneus position in supination and pronation?
20. Why would an equinus occur?
21. Explain closed kinetic chain. What do you think OPEN kinetic chain is?
22. How much dorsiflexion needs to be present for normal gait?
23. Identify arch conditions for forefoot varus and forefoot valgus. What is considered “normal?”

24.How is a gait cycle patterned? What makes a complete cycle?

25.Discuss the swing phase – anatomically.

26.Examine the importance of posture relative to gait.

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