

**BACHELOR IN PROSTHETICS AND ORTHOTICS
FIRST YEAR**

PAPER V – BIOMECHANICS - I

Q.P. Code: 802455

Time: Three Hours

Maximum : 100 Marks

Answer All questions

I. Elaborate on: (3 x 10 = 30)

1. Explain and draw the following plane:
(a) Sagittal plane movements (b) Frontal plane movements
(c) Transverse plane movements
2. Explain with the help of a diagram, kinematics of knee joint during one gait cycle.
3. What is EMG? How is it recorded? Discuss advantages and disadvantages of surface EMG recording over needle EMG?

II. Write notes on: (8 x 5 = 40)

1. Plantar arches and their functions.
2. Explain degree of freedom.
3. Explain parallel and concurrent force system.
4. Discuss advantages and disadvantages of surface EMG recording over the needle EMG.
5. What is whip? Discuss the reasons for whip in Trans femoral prosthesis user.
6. Discuss third law of motion by citing an example?
7. Draw a labelled diagram and explain load deformation curve for connective tissue.
8. What do you understand by eccentric contraction of a muscle? Explain with an Example.

III. Short answers on: (10 x 3 = 30)

1. What is hypo mobility of joint?
2. How many arches are present in foot name them?
3. What is force platform?
4. Define energy. What is its SI unit and dimension?
5. Is velocity a vector or a scalar quantity? Justify with an example.
6. What is osteokinematics?
7. What is the advantage of instrumental gait analysis over conventional video gait?
8. Explain joint reaction forces.
9. Write short notes on biomechanics of syme's prosthesis. Explain with the help of a diagram.
10. Name the different arches of foot.

BACHELOR IN PROSTHETICS AND ORTHOTICS

FIRST YEAR

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Q.P. Code: 802455

Time: Three Hours

Maximum : 100 Marks

Answer All questions

I. Elaborate on:

(3 x 10 = 30)

1. Explain normal human locomotion in details
2. Explain the classification of levers using appropriate figures and examples.
3. Explain biomechanics of ankle joint during gait cycle.

II. Write notes on:

(8 x 5 = 40)

1. Explain parallel and concurrent force system.
2. Why is skin preparation needed before you record surface EMG?
3. Draw a labeled diagram and explain load deformation curve for connective tissue.
4. Explain three point force principle and give any one orthotic example.
5. Explain strain rate sensitivity with an example.
6. State the laws of motion with examples.
7. Define degree of freedom? How many degrees of freedom does hip joint have? Show them with the help of diagram.
8. What do you understand by eccentric contraction of a muscle? Explain with an example.

III. Short answers on:

(10 x 3 = 30)

1. Define Energy. What is its SI unit and dimension?
2. What is force platform?
3. Differentiate Kinematics and kinetics.
4. Describe the biomechanics of Syme's prosthesis with diagram.
5. What is hypermobility of a joint?
6. Define Cadence.
7. Describe the concept of free body diagram.
8. Define motion and explain the types of motion.
9. Define tendon and ligament. Give one function for each.
10. Define stability and instability.

BACHELOR IN PROSTHETICS AND ORTHOTICS
FIRST YEAR
PAPER V – BIOMECHANICS - I

Q.P. Code: 802455

Time: Three Hours

Maximum : 100 Marks

Answer All questions

I. Elaborate on:

(3 x 10 = 30)

1. What are the types of muscles in the body? What do you understand by eccentric contraction of a muscle? Explain with an Example and draw diagrams.
2. Write down the properties of specific tissues with in the human joints and brief.
3. Explain with the help of a diagram, kinematics of knee joint during one gait cycle.

II. Write notes on:

(8 x 5 = 40)

1. Explain degree of freedom.
2. State the law of motion with example.
3. Draw a labelled diagram and explain stress strain curve for connective tissue.
4. Explain three point force principle and give any one orthotic example.
5. Draw and explain the anatomical planes.
6. EMG, its recording and its applications.
7. Tensile forces with examples.
8. Factors determining the active tension in the muscle.

III. Short answers on:

(10 x 3 = 30)

1. Explain Joint reaction forces.
2. What is Force platform?
3. What are concurrent forces?
4. What is vaulting?
5. What is pistoning effect?
6. Is displacement a vector or scalar quantity? Justify with an example.
7. Define Velocity and Acceleration.
8. Define motion and explain the types of motion.
9. Define terms Kinesiology and Biomechanics.
10. Name the different arches of foot?

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0321]

MARCH 2021

Sub. Code: 2455

(AUGUST 2020 EXAM SESSION)

BACHELOR IN PROSTHETICS AND ORTHOTICS

FIRST YEAR (Regulation 2017-2018)

PAPER V – BIOMECHANICS I

Q.P. Code : 802455

Time: Three hours

Answer ALL Questions

Maximum: 100 Marks

I. Elaborate on:

(3 x 10 = 30)

1. Explain about the various types of tissues in the body and list their properties.
2. Explain the different types of levers using examples
3. Write in detail about the kinematics of ankle joint during gait cycle

II. Write notes on:

(8 x 5 = 40)

1. What is EMG? Write about its uses.
2. What is kinetics? Explain in detail.
3. Write about the degrees of freedom.
4. How does the centre of gravity play a role in the stability of human body?
5. How is elasticity beneficial in the human body?
6. Explain about parallel force system.
7. Write about joint hypomobility.
8. Biomechanics of Symes prosthesis.

III. Short answers on:

(10 x 3 = 30)

1. What is acceleration?
2. Define energy? Give examples of types of energy
3. Connective tissue
4. List arches of foot
5. Write about the first law of motion
6. List types of human joints
7. Types of muscle contraction
8. What is vaulting?
9. What is mechanical advantage?
10. Explain the term "Medial".

Time: Three Hours Answer All questions Maximum : 100 Marks

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0423]

APRIL 2023

Sub. Code: 2455

**BACHELOR IN PROSTHETICS AND ORTHOTICS
FIRST YEAR (Regulation 2017-2018 onwards)
PAPER V – BIOMECHANICS I
Q.P. Code: 802455**

Time: Three Hours

Answer All questions

Maximum : 100 Marks

I. Elaborate on :

(3X10=30)

1. Describe the Biomechanics of Normal Anatomical Foot.
2. Gait cycle with reference to its phase and sub-phases with suitable diagrams.
3. What is an Anatomical joint? Discuss structural and functional classification of a Bone.

II. Write Notes on :

(8X5=40)

1. Plantar arches and their functions.
2. Biomechanics of Symes Prosthesis.
3. Concepts of Differentiation and Integration.
4. Explain parallel and concurrent force system.
5. State the laws of motion with examples.
6. Explain in brief the parameters of Gait.
7. Explain forces on foot and ankle joint during gait cycle.
8. Explain stress relaxation with an example.

III. Short Answers on :

(10X3=30)

1. Define – Biomechanics, Kinematics and Kinetics.
2. Forces and its types.
3. Define work. What is its SI unit and dimension?
4. Differentiate between Scalar and Vector quantities with examples.
5. Define pathological gait with examples.
6. What are the sub-division of stance phase of gait?
7. Define the degree of freedom. How much degree of freedom does the Ankle Joint have?
8. Explain the Biomechanics of Non-articulated AFO.
9. What do you mean by Equilibrium? Explain.
10. Describe the concept of free body diagram.

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 1123]

NOVEMBER 2023

Sub. Code: 2455

BACHELOR IN PROSTHETICS AND ORTHOTICS

FIRST YEAR (Regulation 2017-2018 onwards)

PAPER V – BIOMECHANICS I

Q.P. Code: 802455

Time: Three Hours

Answer All questions

Maximum : 100 Marks

I. Elaborate on :

(3X10=30)

1. Discuss mechanical principles governing human motion.
2. Discuss General properties of the Connective tissues.
3. Discuss complexity of Human joint design.

II. Write Notes on :

(8X5=40)

1. Biomechanics of the Foot.
2. Biomechanics of the ankle foot Orthosis.
3. Biomechanics of the below knee (trans tibial) Prosthesis.
4. Concepts of differentiation and integration.
5. Distinguish between Concurrent force systems and Parallel force systems.
6. Bone Modeling and Remodeling.
7. Ground Reaction Force (GFR).
8. Stride and Temporal Parameters.

III. Short Answers on :

(10X3=30)

1. Cartilage.
2. Ligament.
3. Tendon.
4. Bursa.
5. Synovial fluid.
6. Meniscus.
7. Physiological Work.
8. Moment arm of force.
9. Force of friction.
10. Direction of Motion.

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0424]

APRIL 2024

Sub. Code: 2455

BACHELOR IN PROSTHETICS AND ORTHOTICS

FIRST YEAR (Regulation 2017-2018 onwards)

PAPER V – BIOMECHANICS I

Q.P. Code: 802455

Time: Three Hours

Answer All questions

Maximum : 100 Marks

I. Elaborate on :

(3 X 10 = 30)

1. Explain Biomechanics of ankle and foot during gait cycle.
2. Explain details using appropriate figures about the biomechanics of Trans-tibial Prosthesis and Biomechanical gait deviation faced by excessive anterior displacement of socket over foot during initial contact to mid-stance phase of gait cycle.
3. Describe in detail arches of anatomical foot. Explain their functions.

II. Write Notes on :

(8 X 5 = 40)

1. Windlass mechanism of Foot.
2. Biomechanical function of heel wedges.
3. Kinematics of ankle joint.
4. Explain parallel and concurrent force system.
5. Biomechanics of UCBL foot Orthosis.
6. Define degree of freedom? How many degrees of freedom does hip joint have? Show them with the help of diagram.
7. Draw and explain the Anatomical planes and axis.
8. Explain three-point force principle and explain how this principle controlling plantar flexion and dorsi flexion in solid ankle foot Orthosis.

III. Short Answers on :

(10 X 3 = 30)

1. What is Force platform?
2. Define Tendon and Ligament. Give one function for each.
3. Define Velocity and Acceleration.
4. Define Equilibrium.
5. Define Stride length.
6. What is vaulting?
7. What is the purpose of recording EMG while performing gait analysis?
8. Define the difference between Kinematics and Kinetics.
9. Define FES.
10. Define Torque with examples.

BACHELOR IN PROSTHETICS AND ORTHOTICS

FIRST YEAR (Regulation 2017-2018 onwards)

PAPER V – BIOMECHANICS I

Q.P. Code: 802455

Time: Three Hours

Answer All questions

Maximum : 100 Marks

I. Elaborate on :

(3 X 10 = 30)

1. Biomechanical control of Ankle Foot Orthosis (AFO) during gait cycle and explain stance phase rockers.
2. Explain normal human gait cycle in detail.
3. Describe in detail about Kinematics and Kinetics of anatomical ankle and foot.

II. Write Notes on :

(8 X 5 = 40)

1. Functions of plantar fascia.
2. Discuss Newton's first law of motion by citing an example.
3. Parallel force systems.
4. Explain Plane and axis with neat labelled diagram.
5. Define degree of freedom. How many degrees of freedom does ankle joint have? Show them with the help of a neat diagram.
6. Biomechanics of Symes Prosthesis.
7. Draw a labelled diagram and explain load deformation curve for connective tissue.
8. Explain biomechanics of partial foot prosthesis.

III. Short Answers on :

(10 X 3 = 30)

1. What is hypomobility of Joint?
2. Is displacement a vector or scalar quantity? Justify with an example.
3. In which plane will you record movement of abduction and adduction of shoulder or leg? Draw the corresponding plane showing this movement.
4. Define terms Kinesiology and biomechanics.
5. Name the different arches of foot.
6. Define step length and step duration.
7. Describe the concept of free body diagram.
8. Explain joint reaction forces.
9. Muscle work and its types.
10. What do you mean by Equilibrium? Explain.

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0425]

APRIL 2025

Sub. Code: 2455

BACHELOR IN PROSTHETICS AND ORTHOTICS

FIRST YEAR (Regulation 2017-2018 onwards)

PAPER V – BIOMECHANICS I

Q.P. Code: 802455

Time: Three Hours

Answer All questions

Maximum : 100 Marks

I. Elaborate on :

(3 X 10 = 30)

1. Explain the Biomechanics of Partial Foot Prosthesis.
2. Explain with the help of a diagram, kinematics of knee joint during one gait cycle.
3. Describe how the forces act on below knee stump during walking with Prosthesis. Explain with neat diagram.

II. Write Notes on :

(8 X 5 = 40)

1. Explain the Biomechanics of Non-Articulated Ankle-Foot Orthosis.
2. Draw a labeled diagram and explain load deformation curve for connective tissue.
3. Explain the Biomechanics of Subtalar joint.
4. Explain the Biomechanics of FRO (Floor Reaction Orthosis).
5. Discuss laws of motion by citing examples of each.
6. What do you understand by eccentric contraction of a muscle? Explain with an example.
7. Explain Kinematics and Kinetics of normal gait.
8. Explain the different types of levers found in Human body.

III. Short Answers on :

(10 X 3 = 30)

1. What is hypo mobility of joint?
2. How many arches are present in foot? Name them.
3. What is force platform?
4. Define energy. What is its SI unit and dimension?
5. Define – Force, Pressure and Torque.
6. Define State of Equilibrium.
7. Define tendon and ligament. Give one function for each.
8. What are the properties of skeletal tissues?
9. Draw the labeled diagram of anatomical reference planes.
10. Explain the rockers of stance phase of gait cycle.

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 1125]

NOVEMBER 2025

Sub. Code: 2455

BACHELOR IN PROSTHETICS AND ORTHOTICS

FIRST YEAR (Regulation 2017-2018 onwards)

PAPER V – BIOMECHANICS - I

Q.P. Code: 802455

Time: Three Hours

Answer All questions

Maximum : 100 Marks

I. Elaborate on :

(3 x 10 = 30)

1. Describe Biomechanical behavior of Bone.
2. Describe Normal Human locomotion.
3. Describe the Biomechanics of below knee (trans tibial) prosthesis.

II. Write Notes on :

(8 x 5 = 40)

1. Three main types of cells in bone tissue.
2. Characteristics of a synovial joint.
3. Outline the effect of stress on a bone.
4. Distinguish between Concentric and eccentric activity of muscles.
5. Biomechanics of Ankle joint.
6. Biomechanics of Foot Orthosis.
7. Biomechanics of Symes prosthesis.
8. Ground Reaction Forces.

III. Short Answers on :

(10 x 3 = 30)

1. Mass Centroid.
2. Distinguish between vector and scalar quantities.
3. Free Body Diagram.
4. Metric system of measurement.
5. Lever system in human body with example.
6. The four characteristics of a force.
7. The coefficient of friction (μ).
8. Curvilinear motion.
9. Momentum (M).
10. Potential energy.
