



**MASINDEMULIROUNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

FIRST YEAR SECOND TRIMESTEEEXAMINATIONS

FOR THE DEGREE

OF

BACHELOR OF SCIENCE IN PHYSIOTHERAPY

COURSE CODE: BSP 214

COURSE TITLE: BIOMECHANICS

DATE: ----- TIME: -----

INSTRUCTIONS TO CANDIDATES

Answer all Questions

Sec A: Multiple Choice Questions (MCQ) 20 Marks

Sec B: Short Answer Questions (SAQ) (40 marks)

Sec C: Long Answer Questions (LAQ) (40 marks)

TIME: 3 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

SECTION A

MULTIPLE CHOICE QUESTIONS 20 MARKS

1. Which of the following is the most appropriate definition of biomechanics?
 - A. the study of human movement
 - B. the study of biological organisms
 - C. the study of movement mechanics
 - D. the study of the mechanical aspects of biological organisms
2. Which of the following terms is applied to the study of systems in a constant state of motion?
 - A. statics
 - B. dynamics
 - C. anthropometrics
 - D. plyometrics
3. Which of the following would not be measured in a kinematic analysis of a tennis serve?
 - A. angular velocity
 - B. linear velocity
 - C. muscular force
 - D. angular acceleration
4. Which of the following is an example of a kinetic consideration?
 - A. muscle force producing a vertical jump
 - B. impact force landing from a jump
 - C. both A and B
 - D. neither A nor B
5. Which of the following is associated with kinematics?
 - A. force
 - B. displacement
 - C. mass
 - D. all of the above
6. Biomechanical research has contributed to which of the following?
 - A. injury prevention
 - B. enhanced sport performance
 - C. equipment design
 - D. all of the above
7. Which type of analysis involves identifying, analyzing and answering a question of interest?
 - A. quantitative
 - B. qualitative
 - C. both A and B
 - D. none of the above
8. Which of the following characteristics of a vector represents magnitude?
 - A. its angle of orientation
 - B. its length

- C. its direction
 - D. all of the above
9. Which of the following types of force exerts a pull on the body as in muscle contraction?
- A. shear
 - B. compression
 - C. tension
 - D. all of the above
10. Which of the following types of force exerts a pull on the body as in muscle contraction?
- A. shear
 - B. compression
 - C. tension
 - D. all of the above
11. Which of the following types of force exerts a pull on the body as in muscle contraction?
- A. shear
 - B. compression
 - C. tension
 - D. all of the above
12. Which of the following types of force exerts a pull on the body as in muscle contraction?
- A. shear
 - B. compression
 - C. tension
 - D. all of the above
13. Which type of lever is most effective in sport movements?
- A. Third class
 - B. Second class
 - C. First class
 - D. None of the above
14. The cartilage which serves to cushion the impact of large forces on bone ends is called
- A. Fibrous cartilage
 - B. Hyaline cartilage
 - C. Notch
 - D. fossa
15. The skeleton of thorax is made up of
- A. Cartilage
 - B. Bone
 - C. Both (a) and (b)
 - D. None of the above.
16. Which of the following muscle(s) is an example of linear force system
- A. Sartorius
 - B. IT band
 - C. Iliopsoas
 - D. Deltoid
17. Which one of the following is not a cervical flexor muscle?
- A. rectus capitus anterior

- B. hyoid muscles
 - C. longuscapitis
 - D. internal oblique
18. Which movement generates shear stress in the intervertebral discs?
- A. Spinal rotation
 - B. Lumbar flexion
 - C. Thoracic scoliosis
 - D. Cervical hyperextension
19. Side-to-side translation (gliding) occurs in which plane
- A. Frontal plane
 - B. Sagittal plane
 - C. Horizontal plane
 - D. Vertical plane
20. Zygapophyseal joints resist some of the shear force in which region
- A. Cervical
 - B. Thoracic
 - C. Lumbar
 - D. Sacral

SECTION B SHORT ANSWER QUESTIONS

40 MARKS

1. Explain why it is important to study biomechanics 10 marks
2. Biceps muscle inserts 5 cm from the elbow joint. Janerose is carrying a handbag weighing 6 kg on the distal end of the forearm that is 20 cm from the elbow joint on the same upper limb. Calculate the amount of force that the biceps muscle should produce to carry the bag in an elbow flexion position. 10 Marks
3. *Describe* Discuss the SAID Principle in Biomechanics 10 marks
4. Explain the functions and characteristics of the skeletal muscles 10 marks

SECTION C: LONG ANSWER QUESTION

40 MARKS

1. Explain in detail the "force couple", a type of parallel force system, giving example of the movement in a human body, muscles involved and abnormalities that results due to any failure/imbalance of the muscles involved. 20 marks
2. Discuss the abnormal spine curvature giving their causes and management 20 Marks
3. A woman is standing with a weight. Her head, trunk, and arms weigh 50lbs and have a LOG passing 1inches in from her lumbar spine. The 45 lbs weight she is holding is 12 inches from her spine. She then bends with LOG passing 10 inches in from her lumbar spine. finally she lowers the object, with her knees flexed and a neutral lumbar spine, LOG passes at 7 inches in from her lumbar spine.
Calculate what flexion moment do her back muscles need to overcome in these three positions and advice best position to lift the load? 20 marks

BIOMECHANICS I (3 Units)

Purpose of the Course

Biomechanics involves the study of basic concepts of human movement and application of various biomechanical principles in the evaluation and treatment of musculoskeletal system.

Expected Learning Outcomes

After completing the study the student should be able:

1. The students will be introduced to the importance of nutrition to health.
2. To apply mechanical principles of various treatment methods.
3. To analyze posture and gait.

Course Content:

Basic concepts in Biomechanics: Kinematics and Kinetics

Types of Motion, Location of Motion, Direction of Motion, Magnitude of Motion. Definition of Forces, Force of Gravity, Reaction forces, Equilibrium. Objects in Motion, Force of friction, Concurrent force system, Parallel force system. Work, Moment arm of force, component, Equilibrium of levers.

Joint Structure and Function

Joint design. Materials used in human joints. General properties of connective tissues. Human joint design. Joint function. Joint motion. General effects of disease, injury and immobilization.

Muscle structure and functions

Mobility and stability functions of muscles. Elements of muscle structure. Muscle function. Effects of immobilization, injury and ageing.

Biomechanics of the thorax and Chest wall

General structure and function. Rib cage and the muscles associated with the rib cage. Ventilation motion: its coordination and integration. Developmental aspects of structure and function. Changes in normal structure and function in relation to pregnancy, scoliosis and COPD. The Temporomandibular Joint: General features, structure, function and dysfunction.

Biomechanics of the vertebral column

General structure and function. Regional structure and function – cervical, thoracic, lumbar and sacral. Muscles of the vertebral column. General effects of injury and ageing.

Practical

90 Hours will be conducted for various joint movement and analysis of the same. Demonstration will be given as how to analyze posture and gait.

The student will be taught and shown how to perform analysis for activity 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 demonstration will be done on models or skeleton.

Mode of Delivery

Lectures

Audio-visual Aids

Demonstration

Hands on practical in the laboratory

Course Assessment

Written examination 50%

Continuous assessment Examination 30%

Practical examination 20%

Core Reading Materials

Laura Smith, Elizabeth Weiss, Don Lehmkuhl (1996). Brumstrom, Clinical Kinesiology. F. A. Davis Company; 5th edition ISBN – 10: 0803679165

Dawn L. L, Nihat O., Margareta N. (2010). Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation Springer books. ISBN – 10: 038798833

James Watkins (2010). Structure and Function of the Musculoskeletal System – 2nd Edition ISBN – 13 9780736078900

Recommendation Reference Materials

Susan Hall (2006). Basic Biomechanics McGraw – Hill McGraw – Hill 5th Edition ISBN: 0073044814

Arthur Chapman (2008) Biomechanical Analysis of Fundamental Human Movements ISBN – 13: 9780736064026