

**Master of Biomedical engineering**  
**1st year 1st semester exam, 2023-24**

**Subject - Biomechanics**

**Full marks -100**

**time - 3 hrs**

*Answer question no 1 and any five from the rests.*

1. Answer any ten.

10x3=30

- a. What do you mean by kinesiology?
- b. Why do we call bone a nano bio composite?
- c. What are the functions of cartilage?
- d. What is the role of force plate in gait analysis?
- e. Why do you call bone an anisotropic material?
- f. What is the meaning of stress shielding?
- g. What is the relevance of inertia force in studying human locomotion?
- h. What is the importance of area moment of inertia in case of buckling of long bones like femur?
- i. What are the functions of ligament?
- j. What is the importance of Reynolds number in biofluid mechanics?
- k. What is boundary lubrication in human joints?
- l. What is meant by viscoelastic deformation?

[ Turn over

2. a. What is meant by piezoelectric behaviour of cortical bone?
- b. How does human bone respond against different types of loading, compressive, tensile and shear?
- c. Draw a neat sketch to describe the structure of cortical bone.
- d. What do you mean by Wolf's law? Explain its importance in bone remodelling.
- e. What is cancellous bone? 2+3+4+4+1
3. a. What is the structure of cartilage?
- b. How does a cartilage maintain osmotic pressure within it?
- c. What are the roles of muscles in augmenting the stress distribution on bone?
- d. Explain what is meant by boot-trap fracture? 4+3+4+3
4. a. Refer to figure A, draw the free body diagram and find out the joint reaction and the muscle force.
- b. Refer to figure B and replace the system of forces with a single force and moment acting at point A. 7+7
5. a. What is squeeze film lubrication?
- b. What do you mean by hydrodynamic and hydrostatic lubrication in human joints?
- c. What is boosted lubrication?
- d. Explain what do you mean by permeability of cartilage? How does it vary with pressure? 3+4+3+4

6. a. Compare stress strain diagrams of collagen and elastin.
- b. What are the stages of fracture in collagen?
- c. How can you correlate the structure and directional properties of collagenous tissues?
- d. What is the structural and functional speciality of anterior cruciate ligament? 4+3+4+3

7. Write short notes on any four. 3.5x4=14

- a. Laminar flow and turbulent flow.
- b. Newtonian fluid and non-Newtonian fluid.
- c. Continuity equation and Bernoulli equation.
- d. Flow separation and vorticity in blood flow through artery with constriction.
- e. Dynamic similarity and geometric similarity in flow simulation.