

**MASTER OF BIOMEDICAL ENGINEERING 1st YEAR 1st SEMESTER
EXAMINATION 2025**

BIOMECHANICS

Time: 3 hours

Full Marks: 100

Answer Question No. 1 and any 5 from the rest

1. Answer any Ten

 $10 \times 3 = 30$

- a. What is meant by Wolf's law?
- b. What is the effect of porosity on mechanical behaviour of human cortical bone?
- c. Why do we call cortical bone a nano bio-composite?
- d. What is chondrocyte?
- e. What do you mean by non Newtonian fluid?
- f. What is kinematic viscosity?
- g. What are the functions of human cartilage?
- h. What are the functions of cancellous bone?
- i. What is the utility of a force plate?
- j. What is the difference between laminar flow and turbulent flow?
- k. What is the meaning of clubbed foot?
- l. What is mass moment of inertia?

2.a. Draw a neat sketch of osteon and show different parts.

2.b. What is the role of haversian canal and volkmans canal?

2.c. Give one example and discuss the role of muscle contraction in augmenting the stress acting on bones?

2.d. What is the effect of ageing on the strength of human bone?

 $5+3+3+3$

3.a. Refer to fig A and find out the reaction forces developed at the elbow joint and also the muscle force.

3.b. Refer to fig B and replace the system of forces with a single force moment system to be applied at Point A. Also check if the force and moment are perpendicular to each other or not.

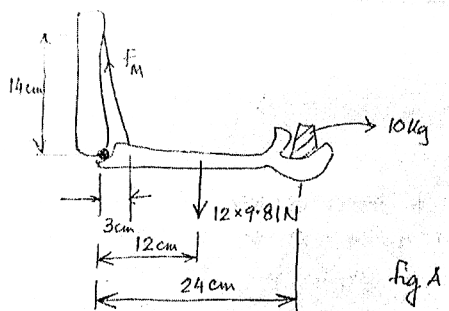
 $6+(6+2)$ 

Fig. A

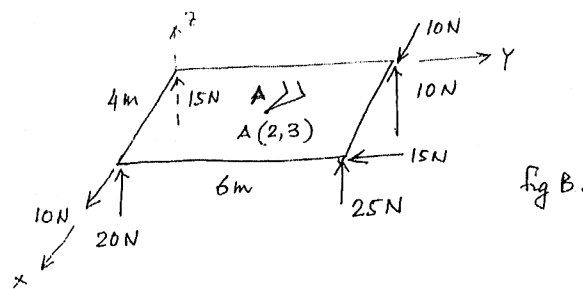


Fig. B

4.a. Differentiate between ligament, tendon and skin.

4.b. Draw load deformation diagrams of collagen and elastin.

4.c. What is the special feature of anterior cruciate ligament?

4.d. Discuss briefly the effect of loading on the recovery of human cartilage?

 $4+4+3+3$

[Turn over

- 5.a. What is area moment of inertia?
- 5.b. How does area moment of inertia can influence the stress developed in long human bones like femur?
- 5.c. What is the usual difference between the fracture of tibia for a football player and a basketball player?
- 5.d. What is the effect of walking on the different types of stress development on human tibia? Describe briefly.
- 5.e. Why should we avoid cutting a long human bone along its length during surgery? 2+3+3+4+2
6. Write short notes on any **Four** 3.5 × 4 = 14
- a. Reynolds number
 - b. Anisotropic behaviour of bone
 - c. Boot trap fracture
 - d. Permeability of cartilage
 - e. Boundary lubrication in human joints
 - f. Importance of Stick diagram in human gait analysis
- 7.a. Write down the Bernoulli's equation and explain its utility in biomechanics.
- 7.b. What is meant by squeeze film lubrication in human joints?
- 7.c. What is restenosis?
- 7.d. What is boundary layer separation and reattachment length in case of blood flow through stenosed artery? 4+3+3+(2+2)