GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI EXAMINATION – SUMMER 2025

Subject Code: 3160308   **Date: 28-05-2025**
Subject Name: Biomechanics
Time: 10:30 AM TO 01:00 PM   **Total Marks:70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1*	**(a)**	Define Coplanar forces and Non-coplanar forces.	**03**
	(b)	Derive Hagen-Poisseuille equation for flow rate.	**04**
	(c)	What are various types of upper and lower limb joints in human body? Explain the movements provided by each joint.	**07**
Q.2	**(a)**	State First, Second and Third Newton's laws of motion.	**03**
	(b)	Write comparison between muscles and ligaments.	**04**
	(c)	Explain biomechanics of heart valves with necessary derivations.	**07**
		OR	
	(c)	Explain the testing of mechanical heart valves.	**07**
Q.3	**(a)**	Describe Laminar and Turbulent flow.	**03**
	(b)	Define Lever. Explain the basic difference between different types of levers using a diagram.	**04**
	(c)	List and explain the rheological properties of blood.	**07**
		OR	
Q.3	**(a)**	Define biocompatibility. Write requirements of a biomaterial to design implants.	**03**
	(b)	Elaborate Kelvin-Voight model of soft tissue.	**04**
	(c)	Explain in detail biomechanics of spinal column.	**07**
Q.4	**(a)**	Define following with relevant diagram: 1) Flexion, 2) Abduction and 3) Circumduction.	**03**
	(b)	Explain in detail Hill's muscle model.	**04**
	(c)	Enlist and explain in brief different force systems.	**07**
		OR	
Q.4	**(a)**	Describe Bernoulli's principle.	**03**
	(b)	Describe procedure for analyzing the forces and moments acting on rigid bodies in equilibrium.	**04**
	(c)	Explain GAIT cycle in detail.	**07**
Q.5	**(a)**	Explain briefly moment of inertia.	**03**
	(b)	Write Comparison of Elasticity and Viscoelasticity of materials.	**04**
	(c)	Explain about biomechanics of Bone in detail.	**07**
		OR	
Q.5	**(a)**	Define Kinematics and Kinetics.	**03**
	(b)	Explain mechanical properties of cartilage.	**04**
	(c)	A person is sitting in a chair with the right leg held in horizontal position. Consider the weight of the foreleg to be 40N and CG at 15cm from knee joint. The muscle acting to keep the foreleg in the horizontal position is connected to foreleg at 5cm distance from the knee. If additional weight is applied at the foot, which is at 40cm	**07**

from knee, what will be the force generated by the muscle if the foreleg is still in static equilibrium? Assume upper leg to be immobile.

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