Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI(NEW) EXAMINATION – WINTER 2022
Subject Code:3160308   **Date:16-12-2022**
Subject Name:Biomechanics
Time:02:30 PM TO 05:00 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.**

Q.1	**(a)**	Give statements of all Newton's Laws of Motion. (All three)	**03**
	(b)	Define Lever. Explain the basic difference between different types of levers using a diagram.	**04**
	(c)	(i) Define Force. (ii) Explain the method to calculate the resultant force if 2 forces are acting on the same point (iii)Explain the method to calculate the resultant force if more than 2 forces are acting on the same point. For (ii) & (iii) Support you answer with necessary mathematical equations or derivation with a diagram.	**07**
Q.2	**(a)**	Write down the Bernoulli equation with all necessary parameters.	**03**
	(b)	Define the following terms in the context of Fluid Mechanics: (i) Reynolds Number (ii) Fluid (iii) Viscosity (iv) Newtonian Fluid	**04**
	(c)	Explain in detail the Rheological Properties of Blood.	**07**
		OR	
	(c)	Explain in detail the types of Artificial Heart Valves.	**07**
Q.3	**(a)**	Explain the structure and composition of Bone.	**03**
	(b)	Explain briefly the testing process of Artificial Heat Valves.	**04**
	(c)	Explain Maxwell and Kelvin – Voight Model with the necessary diagram and equation.	**07**
		OR	
Q.3	**(a)**	State the various function of (i) Tendons (ii) Cartilage	**03**
	(b)	Is Blood a Newtonian Fluid or a Non-Newtonian Fluid? Support your claim by giving appropriate proof or an explanation.	**04**
	(c)	Explain in details the Hill's Muscle Model.	**07**
Q.4	**(a)**	Define Freebody diagram and explain briefly the need of Free body diagram in Biomechanical analysis.	**03**
	(b)	Explain briefly the various types of forces acting on Human Joints.	**04**
	(c)	A weightlifter is holding a 50.0-lb weight with his forearm, as shown in Figure 1. The forearm is positioned at β=60° with respect to the upper arm. The forearm is supported by a contraction of the biceps muscle, which causes a torque around the elbow. Assuming that the tension in the biceps acts along the vertical direction given by gravity, what tension must the muscle exert to hold the forearm at the position shown? What is the force on the elbow joint? Assume that the forearm's weight is negligible.	**07**
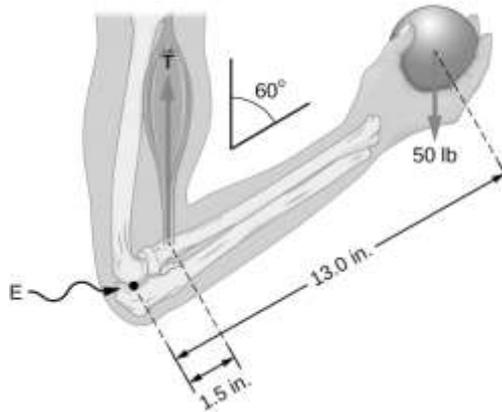
(Figure 1)

OR

Q.4	**(a)**	Enlist necessary assumptions that need to be made before biomechanical analysis of any Human Joint.	**03**
	(b)	Classify the various types of Joints.	**04**
	(c)	(i) State the type of Lever in case of (i) Hip Joint (ii) Knee Joint (iii) Elbow Joint (iv) Shoulder Joint	**07**
		(ii) What is the anatomical similarity between Hip Joint & Shoulder Joint?	
		(iii)Discuss with appropriate example/proof which joint is having higher mechanical advantage among all the Lower and Upper Limb Joints.	

Q.5	**(a)**	Justify the statement "Location of Armrests in chair play a crucial role in the overall stability of body during sitting posture"	**03**
	(b)	State the role of selection & properties of Biomaterial for considering the overall mechanics of the designed Prosthesis.	**04**
	(c)	Enlist and explain the various specification to be considered while designing the prosthetic joint.	**07**

OR

Q.5	**(a)**	Explain various factors taken care in mind while designing the back support of the office chair.	**03**
	(b)	Enlist all the manufacturing steps in the design process of Implants.	**04**
	(c)	Explain in detail the method for analysis of the GAIT cycle.	**07**

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