Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022

Subject Code:3160308 Date:08/06/2022

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)**	Explain blood circulation pathway in human body and also mention classification of circulations in this pathway.	**03**
	(b)	Give comparison in terms of similarities and differences between muscles and ligaments.	**04**
	(c)	Explain Kelvin-Voight model in detail.	**07**
Q.2	**(a)**	Compare Laminar and Turbulent flow.	**03**
	(b)	Derive Hagen-Poisseuille equation for flow rate.	**04**
	(c)	Discuss Aortic Valve Dynamics in detail with proper diagrams.	**07**
		OR	
	(c)	Explain the testing of mechanical heart valves.	**07**
Q.3	**(a)**	Define following and give relevant diagram: 1) Flexion, 2) Abduction and 3) Circumduction	**03**
	(b)	Compare Class-I and Class-II lever.	**04**
	(c)	In a cartesian coordinate system, following data are given: F_1 = 50N with θ_X = 30° above horizontal is applied at point (-5,-2) in the direction of 1st quadrant. F_2 = 150N with θ_X = 30° below horizontal is applied at point (2,5) in the direction of 3rd quadrant. Calculate net moment generated at reference point (0,0).	**07**
		OR	
Q.3	**(a)**	$F_1 = 20\hat{i}$ N, $F_2 = -15\hat{i}$ N and F_3 = 10N with θ_X = 55° above horizontal. Calculate the resultant force using Pythagoras Theorem.	**03**
	(b)	Under what conditions 2 forces will be called '***Couple Forces***'? If force magnitude is 100N, then calculate couple moment. Assume necessary data and mention it clearly.	**04**
	(c)	Enlist and explain in brief different force systems.	**07**
Q.4	**(a)**	Give detailed structural classification of joints.	**03**
	(b)	Explain Hinge joint in detail with diagram.	**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 30N 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 35cm 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.	**07**

OR

Q.4	**(a)**	Enlist all the bones involved in 1) Knee Joint, 2) Shoulder Joint and 3) Elbow Joint.	**03**
	(b)	Explain Ball and Socket joint in detail with diagram.	**04**
	(c)	A person is doing exercise with dumbbell of 50N in gym. If the person starts from fundamental starting position doing elbow flexion, then what will be the moment generated by the weight at elbow joint when the forearm is at 30° flexion. Consider the distances as below: Elbow to CG of forearm : 12cm Wrist to weight : 5cm CG is at 60% of forearm's length from wrist joint.	**07**
Q.5	**(a)**	Define Biocompatibility. Discuss its implications on implant manufacturing?	**03**
	(b)	Discuss steps in the manufacturing process of mechanical heart valve.	**04**
	(c)	Explain GAIT cycle in detail.	**07**

OR

Q.5	**(a)**	Explain fixation of implants.	**03**
	(b)	Explain design aspects of Hip replacement implants.	**04**
	(c)	Discuss the engineering approaches to analyze the below given 2 sitting postures. 1) Straight Back 2) Forward Bent Back	**07**

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