Exam Date & Time: 28-Jun-2023 (02:30 PM - 05:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEM BTech BME MAKE UP EXAMINATION BME 2251 BIOMECHANICS JUNE/JULY 2023 BIOMECHANICS [BME 2251]

Marks: 50 **Duration: 180 mins.** Descriptive Answer all the questions. Section Duration: 180 mins Answer All questions 1A) Illustrate the pressure-volume curves for a normal functioning lung and an excised human lung (separately) and compare them. (4) 1B) Explain the design principles of prosthetic heart valves. Also, describe the causes of failure of the prosthetic heart valves. (3) 1C) Are there any muscles directly attached to the lungs to aid with respiration? If so, then how? If not, then explain the mechanisms involved to aid with respiration. (3)2A) Compare the three viscoelastic models by deriving the necessary mathematical equations and respective characteristics. (5) 2B) With respect to composition and structure, compare the properties of cortical bone with trabecular bone. (3) Explain the muscle actions that creates various movements. 2C) (2)3A) Describe the excitation-contraction coupling mechanism with a neat sketch and detailed explanation. (4) 3B) Compare the four properties of muscle tissues. (3) 3C) When a sample of a bone is placed under increasing tension, its strain increases linearly at the beginning and then more rapidly, just before it breaks in to two at about 220 N/sq. mm. The corresponding strain at the maximum stress is about 0.012. a. Calculate the max tension the bone can withstand with a cross sectional area of 5 (3) sq. cm just prior to fracture.

b. Determine the extent of elongation of bone (55 cm long) which would occur under

	the max tension.	
	c. Calculate stress on this bone if a tensile force of 10 ⁴ N were applied to it. How much would this bone lengthen?	
4A)	Illustrate the behavioral model of the muscle to understand its mechanical nature and explain its structure.	(3)
4B)	A basketball player is trying to dunk the ball and leaves the ground with a vertical velocity of 3.5 m/s.	
	a. Calculate the player's vertical acceleration immediately after takeoff	
	b. What is the peak height the player's center of gravity will attain if it started at 1.2m?	(3)
	c. How much time elapses before the player will reach his peak height?	
4C)	Compare the internal and external work done during the human movement with respect to mechanical aspects of the human body.	(4)
5A)	Illustrate various kinds of lever with an example each.	(4)
5B)	Compare the effect of torque applied over a period of time and applied over a distance with respect to angular kinetics.	(3)
5C)	A therapist applies a lateral force of 80 N to the forearm at a distance of 25 cm from the axis of rotation at the elbow. The biceps are attached to the radius bone at a 90° angle and at a distance of 3 cm from the elbow joint center.	
	(i) Calculate the amount of force required of the biceps to stabilize the arm in this position	(3)
	(ii) Calculate the magnitude of the reaction force exerted by the humerus bone on the ulnar bone	

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