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MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

V SEM B.Tech (BME) DEGREE END SEMESTER EXAMINATIONS DEC 2020/JAN 2021 SUBJECT: BIOMECHANICS (BME 4302) (REVISED CREDIT SYSTEM) Jan. 8th, Friday, 2021, 2 to 5 pm

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to Candidates:

1. Answer all questions.

- 2. Draw labeled diagram wherever necessary.
- 1. A 0.15 kg baseball strikes the catcher's glove with a horizontal velocity of 40 m/s. The 05 displacement of the baseball due to the deformation of the catcher's glove and the movement of the catcher's hand is 8 cm in a horizontal direction from the instant it first makes contact with the glove until it stops.
 - (a) How much kinetic energy does the baseball possess just before it strikes the glove?
 - (b) How much work does the catcher do on the baseball during the catch?
 - (c) What is the average impact force exerted by the glove on the baseball?
 - (d) Is the work done positive or negative?
- 2. Consider performing CRAC method on hamstrings muscle. Write the complete 03 procedure to explain how the method can be effectively performed.
- 3. Justify with reasons to explain how cortical bones exhibit strong anisotropic 02 characteristics.
- 4. A basketball player is trying to dunk the ball and leaves the ground with a vertical 05 velocity of 3.5 m/s.
 - (a) What is 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?
 - (c) How much time elapses before the player will reach his peak height?
- 5. With an appropriate example, explain why kinetic energy of a system needs to be 03 considered as the ability to perform work in order to change the momentum of the system.

6.	Differentiate the kinds of muscle actions that occur during the angular work performed by the muscles while lifting and lowering a barbell.	02					
7.	An athlete is doing a knee extension exercise using a 100 N dumbbell strapped to her ankle at 40 cm from her knee joint. She holds her leg so that the horizontal distance from her knee joint to the dumbbell is 30 cm.						
	(a) For this position, what torque is created by the dumbbell about the axis through her knee joint.						
	(b) If the moment arm of the knee extensor muscles is 4 cm about the knee joint axis, what amount of force must these muscles produce to hold the leg in the position described? Ignore the weight of the leg.						
8.	Explain in detail about the stride parameters and their relationship which are commonly used to analyze the linear kinematics of walking and running.	03					
9.	Differentiate the abduction movement from the horizontal abduction movement.	02					
10.	 What happens to the skeletal muscle tension, When it is stimulated after the completion of the muscle response to the previous stimulation? When it is stimulated before the completion of the muscle response to the previous stimulation? When the frequency of stimulation is increased? Draw appropriate graphs to explain it. 	05					
11.	Make a comparison between slow twitch and fast twitch muscle fibres.	03					
12.	With an example, explain how inertial force causes modifications during human movement.	02					
13.	Demonstrate with pictorial representation to explain the ability of the human body to float.	05					
14.	Illustrate to show how a javelin can be projected in an effective way so that it completes its trajectory before landing. Also, show what might cause the stalling of a javelin.	03					
15.	During the impact of a baseball bat with a baseball (0.15kg) that was pitched at 92 mph, the bat exerts an average force of 5 kN for a time of 0.002 s. If the ball leaves the bat in	02					

the bat exerts an average force of 5 kN for a time of 0.002 s. If the ball leaves the bat in exactly the opposite direction to the pitch, what will be the velocity of the ball immediately following the impact?