

Name:	
Enrolment No:	

UPES
End Semester Examination, May 2024

Course: Biomechanics
Semester : 2nd
Program: B.Tech Biomedical Engineering
Duration : 3 Hours
Course Code: HSBE1004 **Max. Marks: 100**

Instructions: Attempt all the questions

S. No.	Section A Short answer questions/ MCQ/T&F (20Qx1.5M= 30 Marks)	Marks	COs
Q 1	Bones are composed of collagen which has a low elasticity modulus. Is this statement true or false?	1.5	CO4
Q2	What do you mean by creep?	1.5	CO3
Q3	Kinetics and Kinematics fall under the broad category of statics. Is this statement true or false?	1.5	CO2
Q4	What model would you use to describe the viscosity component of a viscoelastic material?	1.5	CO3
Q5	Define Poisson's ratio.	1.5	CO3
Q6	Bones will fracture sooner when subjected to slow and prolonged stress. Is this statement true or false?	1.5	CO4
Q7	Define gap healing of bones.	1.5	CO4
Q8	Define permeability of a cartilage.	1.5	CO3
Q9	When analyzing joint forces, what does the term "torque" refer to?	1.5	CO3
Q10	What is Wolff's law in bone mechanics?	1.5	CO4
Q11	What do you mean by biomechanics?	1.5	CO1
Q12	Mention the types of muscles in the human body.	1.5	CO2

Q13	Define statics and dynamics.	1.5	CO2
Q14	Inertia depends on which of the following factors? a. position b. force c. mass d. velocity	1.5	CO2
Q15	Draw the free body diagram of a book kept stationary on a table. Assume the table to be at rest.	1.5	CO2
Q16	The coefficient of static friction is greater than dynamic friction. Is this statement true or false?	1.5	CO2
Q17	What is the degree of freedom of a human arm?	1.5	CO2
Q18	Differentiate between scalar and vector quantities.	1.5	CO2
Q19	Give an instance where Newton's third law is applicable to human biomechanics.	1.5	CO2
Q20	Who among the following is considered as the father of modern biomechanics? a. Rene Descartes b. Leonardo DaVinci c. Galileo Galilei d. Giovanni Borelli	1.5	CO1
Section B (4Qx5M=20 Marks)			
Q 1	Show that the transition from Hookean regime to Newtonian regime for a viscoelastic tissue occurs over a relaxation time given by the ratio of dynamic viscosity and Young's modulus.	5	CO3
Q2	Discuss the mechanical properties of cartilage from the biomechanics perspective.	5	CO4
Q3	Estimate the resultant vector of a horizontal displacement of 2.6 km and a vertical displacement of 6.7 km as shown in Fig. 1? What is the angle made by the resultant with the horizontal displacement?	5	CO2

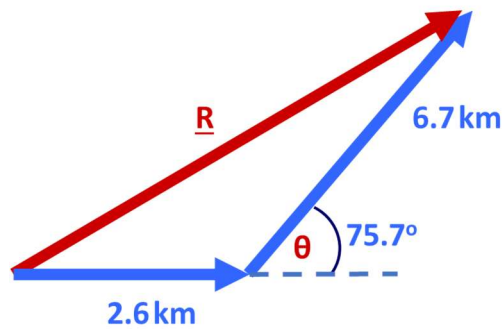


Fig. 1

Q5 Consider a person standing on the ground, which offers friction, being pushed with a constant velocity. Show that the 1st law of equilibrium is valid in this case.

5

CO2

Section C
(2Qx15M=30 Marks)

Q 1 Discuss the validity of Maxwell model and Kelvin-Voigt model for the prediction of stress relaxation.

15

CO3

Q2 Estimate the following as per the schematic shown in Fig. 2.

15

CO2

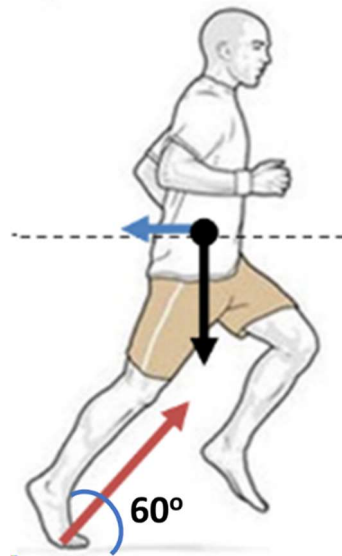


Fig. 2

1. What will be the acceleration if the athlete gets hit by a wind force of 5 N in a direction opposite to the motion? Assume the ground to offer 1.5 N friction.

	2. If the athlete was initially running at 5 km/hr, what is the speed after 10 secs of getting hit by the wind? Assume the mass of the athlete to be 60 kg.		
Section D (2Qx10M=20 Marks)			
Q 1	Describe the process of indirect bone healing in detail.	10	CO4
Q2	Write a note on degrees of freedom of a kinematic link.	10	CO2