Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

1st SEMESTER M. Tech. (BME) DEGREE END SEM EXAMINATIONS FEB/MAR 2021

SUBJECT: BIOMECHANICS AND BIODYNAMICS (BME 5152)

(REVISED CREDIT SYSTEM)

Monday, 1st March 2021, 2 PM to 5 PM

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to Candidates:

1. **Answer all questions.**
2. **Draw labeled diagram wherever necessary.**

1A.	(i) Provide a detailed movement description of glenohumeral joint along with its corresponding planes and axes.	04
	(ii) Compare the extent of mobility of glenohumeral joint with another joint having the same degrees of freedom.	03
1B.	With appropriate examples, justify that bones are designed to meet different requirements and hence are mutually inconsistent.	03
2A.	(i) Make a comparison of different skeletal muscle tensions.	04
	(ii) A shotput leaves the thrower's hand at 15 m/s at angle of 42^o and a height of 1.3m. • What will be the shot's flight time? • What will be the shot's maximum height? • How far will the shot travel from the thrower's hand before it lands?	03
2B.	Explain the different stretching techniques used to improve the flexibility of joints.	03
3A.	At heel strike, a 950 N ground reaction force is generated at an angle of 82^o with respect to ground. At this position, hip, knee and ankle joints are at heights of 0.85m, 0.4m and 0.1m respectively with respect to the ground. The vertical component of the ground reaction force passes through the ankle and at a distance of 0.25m and 0.08m from hip and knee joints respectively. Draw the complete free body diagram and calculate the moments about ankle, knee and hip joints.	04
3B.	(i) Explain how ground reaction and frictional forces be measured using a force plate.	03
	(ii) Illustrate to show how the data obtained from a force plate can be used to calculate the height of a vertical jump.	03

4A. The deltoid muscle in the right upper extremity is attached to the humerus at an angle of 55^o w.r.t the horizontal axis when the upper extremity is abducted to 30^o w.r.t the vertical axis. The perpendicular distance from the deltoid muscle force to the shoulder joint is 1.8 cm. The weight of the upper extremity is 24 N which is acting vertically at a distance of 30 cm from the shoulder joint. Calculate the amount of deltoid muscle force required to maintain a 30^o abduction position of right upper extremity and also the joint reaction force (along with its orientation) generated at the shoulder joint. 04

4B. (i) Draw the complete human walking gait cycle with a representation of reference extremity, phases and sub-phases. 03

(ii) Explain the temporal parameters of a single gait cycle. 03

5A. (i) Describe how overall drag force can be minimized in case of long jump, running, cycling and downhill speed skiing. 04

(ii) Illustrate to show the influence of aerodynamic drag force in case of skydiving. 03

5B. Provide examples to show how different joints in body influences the muscle's angle of pull which eventually impacts the torque generation. 03