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# MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

### I SEMESTER M.Tech (BME) DEGREE MAKE UP EXAMINATIONS DEC/JAN 2019-20 SUBJECT: BIOMECHANICS & BIODYNAMICS (BME 5152) (REVISED CREDIT SYSTEM) Saturday, 28<sup>th</sup> December 2019: 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. Write about all the movements that occur at the ankle joint and also mention the 05 corresponding plane in which the movements occur.
- 1B. Justify the ability of the cancellous bone to resist fracture in spite of being highly porous. 05
- 2A. The medial deltoid muscle attaches to the humerus bone at an angle of 15°. What are the 03 sizes of rotary and stabilizing components of muscle force when the total muscle force is 500 N? Also draw the free body diagram.
- 2B. Provide an example each to explain active and passive Insufficiency. 03
- 2C. Differentiate parallel muscle fiber arrangement from penniform muscle fiber arrangement. 04
- 3A. How much force must be produced by the biceps brachii, attaching at a 90° to the radius 03 bone at 3 cm from the center of rotation at the elbow joint to support a weight of 70 N held in the hand at a distance of 30 cm from the elbow joint?
- 3B. What are the three ground reaction forces measured using a force platform? 03 Diagrammatically show the output of force platform while measuring the GRF in a vertical jump on the platform.
- 3C. Write about the distance parameters of gait.04
- 4A. A basketball player weighing 105 kg, applied a vertical force of 2980 N against the ground 03 for 0.11 seconds. Calculate the height that his center of mass reached during his rebound.
- 4B. Provide an example each (diagrammatically) to explain different classes of levers. 03

4C. A therapist applies a lateral force of 80 N to the forearm at a distance of 25 cm from the 04 axis of rotation at the elbow. The biceps is attached to the radius bone at a 90° angle and at a distance of 3 cm from the elbow joint center.

(i) How much force is required of the biceps to stabilize the arm in this position?

(ii) What is the magnitude of the reaction force exerted by the humerus bone on the ulnar bone?

Also draw the free body diagram.

- 5A. What is the impact of drag force on a cycler compared to a runner? Mention the various 03 positions of a cycler and also explain the different ways to minimize the drag force.
- 5B. Detail the factors affecting the swimming efficiency.

- 03
- 5C. What is the floating position of a true floater? Justify the ability of a true floater to float 04 naturally compared to conditional floater and sinker.