Instructions to Candidates:
1. **Answer all the questions.**
2. **Draw labeled diagram wherever necessary.**

1A. Draw a graph (muscle tension vs. muscle length) to represent active, passive and total tension and also explain it.   **6**

1B. Explain about the bone failure mechanics and also write about the types of bone fracture.   **6**

1C. (i) Write the movements involved in pronation and supination of foot.   **2+6**

(ii) Define all the human movements possible in the sagittal plane.

2A. Draw the stress-strain diagram of tendon & ligament and explain it.   **6**

2B. Explain how the muscle fibers are recruited (i.e) order of muscle fiber activation and deactivation?   **6**

2C. (i) With an example each, define active and passive insufficiency.   **4+4**

(ii) Draw the mechanical model of musculotendinous unit and explain it.

3A. Write about the following factors influencing projectiles: **6**
(i) projection angle
(ii) projection velocity
(iii) relative projection height

3B. Derive the relationship of linear and angular acceleration.   **6**

3C. How do you measure the vertical ground reaction force using a force platform?   **8**

4A. A forearm weighing 35 N is held at an angle of 45° to the vertically oriented humerus bone. The center of gravity of the forearm is located at a distance of 15 cm from the center of the the elbow joint. The elbow-flexor muscles are attached at an average distance of 3 cm from the center of the elbow joint. Calculate the force to be exerted by the elbow-flexors, to maintain the same position. Calculate the force to be exerted by the elbow-flexors, if a weight of 50 N is held in the hand, at a distance of 25 cm from the center of the elbow joint. Draw the free body diagram.   **6**

4B. If the location of hip, knee & ankle joints are (1.14, 0.80), (1.22, 0.51) and (1.09, 0.09) respectively, calculate the angles of thigh & leg segments and also the angle of knee joint.   **6**

4C. With an example, explain in detail about force couple.   **8**

5A. A badminton shuttlecock is struck by a racquet at an angle 35°, giving it an initial speed of 10 m/s. How high will it go? How far will it travel horizontally before being contacted by the opponent's racquet at the same height from which it was projected?   **6**

5B. Explain in detail about the floating position of human body.   **6**

5C. Illustrate to show how lift force is generated in a bottom spinning ball.   **8**