

MANIPAL INSTITUTE OF TECHNOLOGY

IV SEMESTER B.Tech. DEGREE END SEMESTER EXAMINATIONS APRIL/MAY 2017 SUBJECT: BIO-MECHANICS (BME 3282) (Open Elective) (REVISED CREDIT SYSTEM) Tuesday, 2nd May 2017, 2 to 5 pm

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to Candidates:

Answer all the questions. Draw labeled diagram wherever necessary.

- 1. (a) Define all the movements of body segments that move away from midline of the body 05 in the lateral direction.
 - (b) With clear illustrations, show how the translational kinetic energy varies during 03 different phases of a gait cycle.
 - (c) A punter kicks the football, which leaves the punter's foot with a vertical velocity of 20 m/s and a horizontal velocity of 15 m/s. For how long will the ball remain in the air? Assume that the height of release and landing are same.
- 2. (a) Differentiate slow-twitch muscle fibers from fast-twitch muscle fibers. 05
 - (b) A diver weighing 60 kg has an angular velocity of 6 rad/sec about the transverse axis 03 when he leaves the board in a layout position. When the person undergoes tuck position, the angular velocity increases to 24 rad/sec. If the person's moment of inertia is 15 kg.m² in the layout position, what is the person's radius of gyration in the tuck position?
 - (c) Provide an example to show how an antagonist muscle plays an active role during 02 movement.

- 3. (a) A weightlifter has mistakenly placed a 20 kg plate on one end of the barbell and a 15 05 kg plate on the other end of the barbell. The barbell is 2.2 m long and has a mass of 20 kg without the plates on it. The 20 kg plate is located 40 cm from the right end of the barbell, and the 15 kg plate is located 40 cm from the left end of the barbell. Locate the center of gravity of the barbell with the weight plates on it? Also, draw the free body diagram.
 - (b) Explain the biomechanics of trabecular bone. 03
 - (c) What is the significance of pre-stretch in a muscle which has to produce contractile 02 force?
- 4. (a) How does peroneus longus muscle act as a pulley system in the human body, and what 05 kind of movement does it lead to?
 - (b) Explain the effect of centripetal force when a person has to run along the curve of a running track. Also provide the details of changes that need to be made in the movement while running along the curve.
 - (c) The hand exerts a force of 90 N at a distance of 32 cm from the center of the elbow joint. The triceps muscle is attached to the ulna at an angle of 90° and at a distance of 3 cm from the center of elbow joint. The weight of the forearm & hand is 40N with their center of gravity located at a distance of 17 cm from the center of the elbow joint. How much of force is being generated by the triceps in order to maintain that static position? Also, draw the free body diagram.
- 5. (a) Explain the floating ability of a "true floater" and a "sinker". 05
 - (b) Draw necessary figures to show the significance of angle of attack in non-wing shaped 03 objects and also explain it.
 - (c) A person runs a 400 m race around a 400 m track. On the backstretch, his velocity is 8 m/s, but he runs against the headwind of 2 m/s. How much is the drag force that acts on him? Assume that the density of air is 1.2 kg/m³, the person's cross-sectional area is 0.5 m² and the coefficient of drag is 1.1.