Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University, Manipal – 576 104

1st SEMESTER M.Tech. (BME) DEGREE MAKE-UP EXAMINATIONS, DEC/JAN 2015-16

SUBJECT: BIO-MECHANICS & BIO-DYNAMICS (BME 507)
(REVISED CREDIT SYSTEM)
Wednesday, 30th December 2015 : 2.00 pm - 5.00 pm

TIME: 3 HOURS **MAX. MARKS: 100**

Instructions to Candidates
1. Answer any FIVE full questions **2. Draw neat figures wherever necessary**

1. (a) Explain all the movements that are perpendicular to Sagittal axis. (8)

   (b) Describe the effects of drag force in floater volley ball serve and golf ball. (3+3)

   (c) (i) Draw the trajectory of a discus showing the angle of attack, angle of projection and angle of attitude at release, peak and descent. (4+2)

   (ii) A person swimming with an absolute velocity of 1.5 m/s in a river where the velocity of the current is 0.5 m/s. What is the velocity of the swimmer w.r.t the current when the person swims directly upstream and directly downstream?

2. (a) Define the spatial parameters of gait cycle and also explain how they can be measured? (8)

   (b) (i) Explain how the surface drag and wave drag forces act as resistive forces in swimming skills. (4+2)

   (ii) How much force must be produced by the biceps brachii at a perpendicular distance of 3 cm from the axis of rotation at the elbow to support a weight of 200 N at a perpendicular distance of 25 cm from the elbow?

   (c) With appropriate examples, write briefly about muscle rate coding. (6)

3. (a) Illustrate to show how a projectile can generate magnus force in the leftward direction. Also draw the trajectory of the projectile and explain it in detail. (8)

   (b) Write the functions performed by a muscle. (6)

   (c) (i) Give examples to explain about the types of torque. (4+2)

   (ii) What is the resulting angular acceleration of 1.7 kg forearm & hand when the forearm flexors, attaching 3 cm from the center of rotation at the elbow, produce 10 N of tension, given a 90^o angle at the elbow and a forearm & hand with a radius of gyration of 20 cm?

4. (a) Explain about the biomechanical principles: force-motion, force-time, inertia and range of motion. (8)

(b) Write the applications of statics and dynamics in human movement. (6)

(c) (i) How do you perform PNF method for Hamstrings muscle? (4+2)

(ii) How much force must be produced by the fibers of a pennate muscle aligned at a 60^{o} angle to a central tendon to create a tensile force of 200 N in the tendon? What must be the effective minimal cross-sectional area of the muscle?

5. (a) Explain the significance of angle-angle diagrams. (8)

(b) 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)

(c) Write about repetitive vs. acute loads on human body. (6)

6. (a) Explain how the frequency of stimulation plays a major role in generating muscle tension. (8)

(b) (i) How do the slow twitch and fast twitch muscle fibers handle a prestretch? (4+2)

(ii) A 7.27 kg hammer on a 1 m wire is released with a linear velocity of 28 m/s. What reaction force is exerted on the thrower by the hammer at the instant before release?

(c) Provide two appropriate examples to justify that certain bones in the human body are designed to resist fracture. (6)