Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University, Manipal – 576 104

IV SEMESTER B.Tech. DEGREE END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: BIO-MECHANICS (BME 3282) (Open Elective)
(REVISED CREDIT SYSTEM)
Tuesday, May 17th, 2016 : 2.00 pm - 5.00 pm

TIME: 3 HOURS **ANSWER ALL THE QUESTIONS** **MAX. MARKS: 50**

1. (a) A basketball player weighing 105 kg, applied a vertical force of 2980 N against the ground for 0.11 seconds. Calculate the height to which his center of mass reached during his rebound. [2]

   (b) Will a person be able to float horizontally above or below the surface of water without any supportive movements? Justify your answer. [4]

   (c) Explain in detail, the process of muscle excitation-contraction coupling. [4]

2. (a) A forearm weighing 35 N is held at an angle of 45^{o} 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 elbow joint. The elbow-flexor muscles are attached at an average distance of 3 cm from the center of the elbow joint. Calculate the muscle force to be exerted by the elbow-flexors, to maintain the same position. Calculate the muscle 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. [2]

   (b) Illustrate with two examples, the effect of muscle’s “angle of pull” on the magnitude of the torque generated at a joint. [4]

   (c) With appropriate examples, write about the muscle action that creates, opposes, stabilizes and neutralizes movements. [4]

3. (a) A runner weighing 52 kg is running forward at 5 m/s when his foot strikes the ground. The vertical ground reaction force acting under his foot at this instant is 1800 N. The friction force acting under his foot is a 300 N braking force. These are the only external forces acting on the runner other than the gravitational force. What is the runner’s vertical acceleration, as a result of these forces? [2]

(b) The center of mass of the upper-arm segment is at 48.6% of the length of the segment from the shoulder joint along the vertical axis of the segment. Calculate the coordinates of the center of mass of the upper-arm segment with following details: coordinates of shoulder joint and elbow joint are (5.7, 3.2) and (7.9, 4.1) respectively. [4]

(c) What is the point at which the resultant (lift and drag) air-force acts on a projectile? How does it affect the projectile's trajectory? Explain. [4]

4. (a) A racing shell has a volume of 0.38 m^3. When floating on the sea, how many people each weighing about 700 N can it support? [2]

(b) A badminton shuttlecock is struck by a racquet at an angle of 35^o, giving it an initial speed of 10 m/s. Calculate the maximum height it has reached. How far will it travel horizontally before being contacted by the opponent's racquet at the same height from which it was projected? [4]

(c) When an object is projected in the air, how is the profile-drag-force generated? What changes can be implemented in order to reduce the profile- drag-force? [4]

5. (a) The radius of gyration of the thigh-segment with respect to transverse axis at the hip joint is 54% of length of the thigh-segment. The mass of the thigh-segment is 10.5% of total body-mass and the length of the thigh segment is 23.2% of total body-height. What is the moment of inertia of the thigh-segment with respect to the hip joint, having total body mass and height as 60 kg and 1.6 m respectively? [2]

(b) Explain the influence of stride length and stride rate in the gait cycle of a runner. [4]

(c) Differentiate Static stretching from Ballistic stretching. [4]