GANPAT UNIVERSITY

B.Tech. Semester VII Biomedical and Instrumentation Engineering
Regular Examinations Nov/ Dec 2012
BME 704 Biomechanics

Time:- 3 Hours   Marks:- 70

Instructions:
1. Answer to the questions must be written in separate answer books.
2. Figure to the right indicate marks.
3. Assume data, if needed.
4. Conventional terms / notations are used.
5. All the questions are compulsory.

SECTION-I

Q.1

(a) What is musculotendinous unit? Explain all the behavioral properties   1+4
of the musculotendinous unit.

(b) Name three types of plane and provide examples of each.   3

c) Write a short note on loads on the knee joint.   4

OR

Q.1

(a) Draw and explain different types of mechanical loads on the human   4
body.

(b) Write a short note on loads on the ankle joint.   4

(c) Write a short note on length-tension relationship.   4

Q.2

(a) Write a short note on muscular fatigue.   4

(b) Explain the isometric contraction and eccentric contraction in detail.   4

(c) How much torque is produced at the elbow by the biceps brachii   3
inserting at an agle of 50˚ on the radius when the tension in the
muscle is 400N? (Muscle attachment to the radius is 2.5 cm from the
centre of rotation of the elbow joint)

OR

Q.2

(a) How much tension may be developed in muscles with the following cross sectional areas: i) $2cm^2$ ii) $12cm^2$ **2+2**
The tension generating capability of muscle tissue is 90 N/ cm^2

(b) Explain what happens at sarcomere level when a muscle contracts.   **4**

(c) Construct a chart listing all muscles crossing the hip joint according to whether they are anterior, posterior, and lateral to the joint centre.   **3**

Q.3

(a) What is centre of gravity of a human body? Explain the reaction board method to locate the centre of gravity of a human body.   **1+4**

(b) Enlist the types of lever. Explain each type with neat diagram and example.   **1+6**

SECTION-II

Q.4

(a)   **6**

    i.   Define following terms
        (1) Gait (2) Gait cycle (3) Stride (4) Step
    ii.   Describe phases of gait cycle and percentage phases in gait cycle
    iii.   Describe gait events with proper figure.

(b) A basketball is released with an initial speed of 8 m/s at an angle of 60 degree. Find the horizontal and vertical components of the ball's initial velocity, both graphically and trigonometrically.   **6**

OR

Q.4

(a) Two basketball are consecutively hit by a bat.The first ball is hit 40cm from the bat's axis of rotation .If the angular velocity of the bat was 30 rad/s at the instant that both balls were contacted ,what was the linear velocity of the bat at the two contact points?   **6**

(b) Describe in detail factors influencing projectile trajectory with necessary figures.   **6**

Q.5

(a) A swimmer orients herself perpendicular to the parallel banks of a river.If the swimmer's velocity is 2 m/s and the velocity of the current is 0.5 m/s,what will be the swimmer's resultant velocity? How far will the swimmer actually have to swim to get to the other side if the banks of the river are 5om apart?   **6**
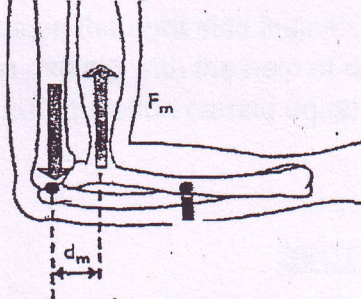
(b)   Explain structure of shoulder in detail.   5

<div align="center">**OR**</div>

Q.5

(a)   A windmill style softball pitcher executes a pitch in   5
0.65bseconds.If her pitching arm is 0.7m long,what are the
magnitudes of the tangential and radial accelerations on the ball
just before ball release when tangential ball speed is 20m/s?What
is the magnitude of the total acceleration on the ball at this point?

(b)   How much force must be produced   3
by the brachioradialis and
biceps(F_m) to maintain the 15N
forearm and hand in the position
shown, given moment arms of 5cm
for the muscles and 15 cm for the
forearm/hand weight?What is the
magnitude of the joint reaction force?

(c)   A swimmer crosses a lake that is 0.9 km wide in 30 minutes. What   3
was his average velocity? Can his average speed be calculated?

Q.6   Answer the following   12
i)   What is the difference between linear kinematics and angular
kinematics?
ii)   What is angle of projection?
iii)   Give the name of factors influencing projectile trajectory?
iv)   Explain right hand rule as per angular motion vectors.
v)   What is Kinematics?
vi)   How the projectile angle has direct implications for success in
basketball?
vii)   Explain foot drop.
viii)   What is pace?
ix)   When a body is projected at an oblique angle,the speed of
projection determines which two factors?
x)   What is projectile?
xi)   As per human gait define speed.
xii)   Draw the figure which shows the relationship between angular
distance and angular displacement.
Answer the following

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