Question Paper

Exam Date & Time: 24-Apr-2018 (09:30 AM - 12:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES IV SEMESTER B.S. (ENGG.) END - SEMESTER THEORY EXAMINATIONS APRIL - 2018 DATE: 24 APRIL 2018 TIME: 9:30 AM TO 12:30 PM Biomechanics [BM 243]

Marks: 100

Duration: 180 mins.

Answer 5 out of 8 questions.

- Assuming that air resistance is negligible, consider an ⁽⁸⁾ athlete who jumps a horizontal distance of 8 m. If the athlete was airborne for 1 sec, calculate the take-off speed,
 - angle of release and maximum height the athlete's center of gravity reached.
 - B) If the location of hip, knee & ankle joints are (1.14, 0.80), (6) (1.22, 0.51) and (1.09, 0.09) respectively, calculate the angles of thigh & leg segments and also the angle of knee joint.
 - ^{C)} Explain the significance of angle-angle diagrams. ⁽⁶⁾
- ²⁾ Explain how the frequency of stimulation plays a major role ${}^{(8)}_{A)}$ in generating muscle tension.
 - (i) How do the slow twitch and fast twitch muscle fibers
 (b) handle a prestretch?
 (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 ⁽⁶⁾ bones in the human body are designed to resist fracture.
- (i) What is the significance of pre-stretch in a muscle which ⁽⁸⁾
 has to produce contractile force? (2+6)
 - (ii) Differentiate slow-twitch muscle fibers from fast-twitch muscle fibers.
 - ^{B)} Consider a diver of 88 kg mass standing on the free end of ⁽⁶⁾ a horizontal diving board at point 'B', preparing for a jump.

The diving board has a uniform thickness and a mass of 56 kg and is mounted to the ground at point 'O'. Point 'A' indicates the center of gravity of the diving board, and it is equidistant from points 'O' & 'B'. Determine the length of the diving board, if the net moment generated about point 'O' by the weight of the diver and the diving board is 3979 Nm. C) (6) Make a comparison of various types of muscle tension. (i) Considering the Young's moduli for long bone to be (8) 30,000, what strain energy is required to deform the bone A) to a strain of 0.1%? How much strain energy is stored in the bone if it is exposed to a stress of 30 MPa? (ii) Provide an example to show how an antagonist muscle plays an active role during movement. (6) B) Write about the various types of floaters. C) Explain how angular momentum of human movement can (6) be calculated. Define all the frontal plane movements. (8) A) B) Describe the effects of drag force in floater volley ball (6)serve and golf ball. (3+3)C) (6) (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) The modulus of elasticity for a prosthetic material is 20 GPa. A 3 cm long sample of this material is circular in cross-section with a radius of 1 cm. this sample is stretched 3.003 cm. What tensile force was applied to the material to create this stretch? Define the spatial parameters of gait cycle and also explain ⁽⁸⁾ how they can be measured? A) ^{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?

(6)

4)

5)

6)

With appropriate examples, write briefly about muscle rate coding.

- ⁷⁾ Illustrate to show how a projectile can generate magnus
 ⁽⁸⁾ force in the leftward direction. Also draw the trajectory of the projectile and explain it in detail.
 - ^{B)} Write the functions performed by a muscle. ⁽⁶⁾
 - (i) Give examples to explain about the types of
 (ii) Give examples to explain about the types of
 (iii) 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° angle at the elbow and a forearm &
 hand with a radius of gyration of 20 cm?
- ⁸⁾ Write all the formulae to calculate the lower extremity joint ⁽⁸⁾ angles.
 - ^{B)} Write the applications of statics and dynamics in human ⁽⁶⁾ movement.
 - (i) How do you perform PNF method for Hamstrings
 (6) muscle?
 (4+2)

(ii) Calculate the amount of torque generated at a joint when a muscle attaching to a bone 3cm from the joint exerts 100 N of tension at the angle of attachment of 30° .

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