



NOVEMBER EXAMINATION

PROGRAM : BACHELOR OF BIOKINETICS
MODULE NAME : BIOMECHANICS
MODULE CODE : BIM 01B1
DATE : 20 NOVEMBER 2017
DURATION : TWO (2) HOURS
TOTAL MARKS : 100 MARKS

EXAMINER : DR A GREEN
MODERATOR : PROF L LATEGAN

INSTRUCTIONS TO CANDIDATES:

PLEASE MAKE SURE THAT YOU HAVE THE COMPLETE PAPER.

ANSWER ALL THE QUESTIONS PLEASE.

DO NOT USE TIPPEX!

A SHEET CONTAINING ALL FORMULAE IS ATTACHED.

GOOD LUCK

Question 1

Two individuals are attempting to pull a boat along a section of a canal. If they both pull the boat at a constant velocity at an angle of 30° from the horizontal plane and use the same force (600 N), calculate the force exerted by the boat on the water.

[3]

Question 2

Identify the plane and axis of rotation of the following movements and list each movement's main or prime movers (agonistic muscles):

- a) Knee flexion [5]
- b) Upward rotation of the scapula [5]
- c) Gleno-humeral horizontal abduction [5]

Question 3

a) An athlete performing the high jump exerts 5500 N of force when attempting a height of 2 m. What is the stress on their Achilles tendon if the cross-sectional area of the Achilles tendon is 2.5 cm^2 ? [3]

b) If the athlete's tendon in the previous problem has a resting length of 7.5 cm and a Young's modulus of 1044.4 N/cm^2 what will be the strain in the tendon? [3]

c) What will the absolute change in length be when the force is applied? [4]

Question 4

Contraction of muscles requires a refined coordinated effort between nervous and skeletal muscle tissues.

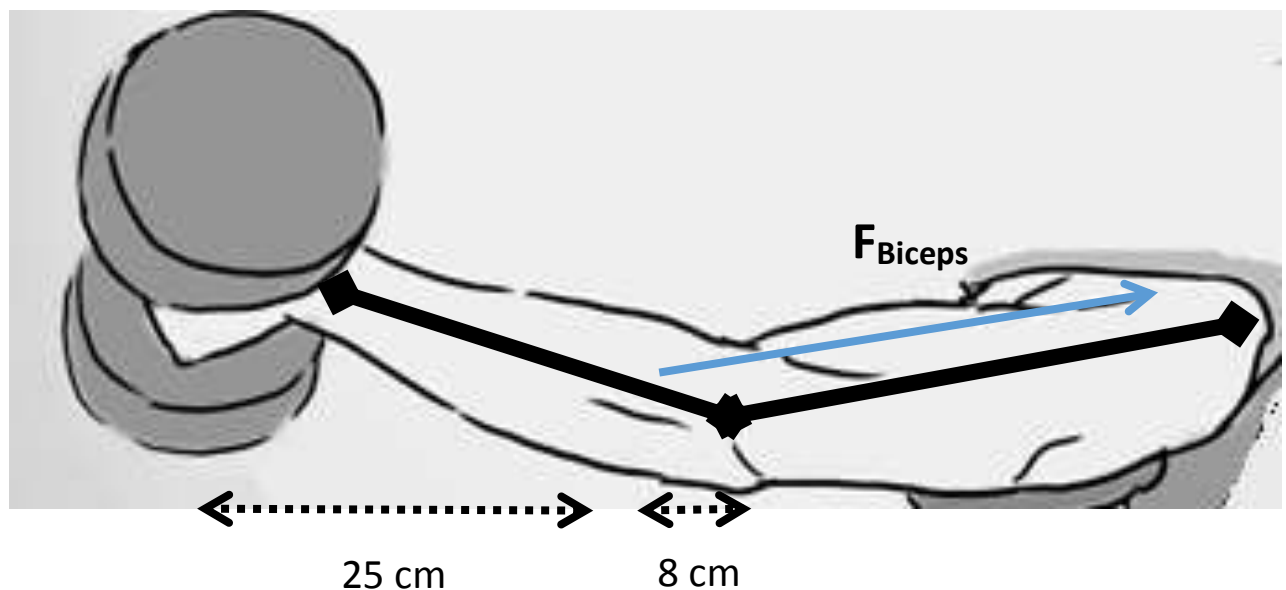
Describe how the nervous system initiates a muscle contraction. [10]

Question 5

Explain how muscle contraction occurs through the sliding filament theory following the innervation from the nervous system [10]

Question 6

A person is holding a 16kg weight as depicted by the figure below.



- a) Calculate the force exerted by the biceps. [5]
- b) How would the neuromuscular system coordinate a muscular contraction required to lift a weight of 24 kg? [3]

Question 7

A jump height increases when the concentric action is immediately preceded by an eccentric action. Explain the most likely mechanisms for this action. [3]

Question 8

- a) How much work is performed when a gym-goer performs 10 squats using a barbell that weighs 90kg, when the squat depth is 0.88m? [5]
- b) If it takes 3 seconds to perform one full squat motion how much power will be required for the 10-squat set? [3]

Question 9

Explain how balance is lost, in terms of

- a) Centre of gravity height [2]
- b) Centre of mass relative to base of support [3]

Question 10

Explain the different classes of levers and give examples of where they occur in the human body. [12]

Question 11

An athlete is attempting a long jump. They leave the take-off board with an initial velocity of 11 m/s at an angle 20° relative to the horizontal. Calculate the:

- (a) Time to reach maximum height [3]
- (b) Maximal height reached; [3]
- (c) Jump distance [4]
- (d) Assuming all parameters remain the same, at what velocity would the athlete have to run to jump a distance of 9m? [2]

Question 12

Why is it advantageous for an individual cyclist to ride in a pack? [4]