UNIVERSITY OF BOLTON

SCHOOL OF SPORT AND BIOLOGICAL SCIENCES

SPORT AND EXERCISE SCIENCE PATHWAY
SPORTS SCIENCE AND COACHING PATHWAY

SEMESTER TWO EXAMINATION 2018/2019

ADVANCED SPORT AND EXERCISE BIOMECHANICS

MODULE NO: SPS6005

Date: Wednesday 22 May 2019 **Time: 2.00 pm – 4.00 pm**

INSTRUCTIONS TO CANDIDATES:

There are 4 questions on this paper, 1 question in section A and 3 questions in section B.

Answer the COMPULSORY question from Section A and the COMPULSORY question from Section B and choose ONE of the CHOICE questions from Section B.

Write your answers in the answer book provided NOT on the question paper. You must clearly label each answer with the corresponding section letter, question number and part letter.

Electronic calculators may be used provided that data and programme storage memory is cleared prior to the examination.

School of Sport and Biological Sciences
Sport and Exercise Science Pathway
Sports Science and Coaching Pathway
Semester Two Examination 2018/19
Advanced Sport and Exercise Biomechanics
Module No. SPS6005

Section A: Theoretical

Answer this COMPULSORY question from this section.

1. Figure 1 shows a typical forearm lever system. The athletes mass is 96.2 kg; the moment of inertia of the forearm and hand is **0.0075 kg * m^2** ; the radius of gyration of the forearm and hand is **82.7 %.**

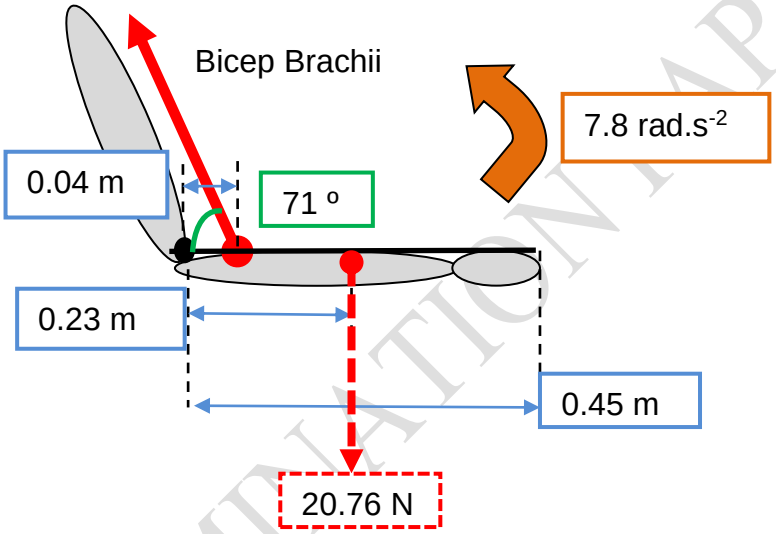

Figure 1: Dynamic acceleration of the elbow joint

a) What classification of lever system is that presented in Figure 1? Does this provide a mechanical advantage or disadvantage? Provide the moment arm ratio to support your answer.

(5 marks)

b) What is the muscular force required, from the Biceps Brachii and the scenario presented in Figure 1, to maintain this static position? Consider information provided above, including the moment arms (blue); angle of muscle action (green); and weight of the segments (dotted red).
[Formula 1: M = F x d; Formula 2: Σcwm + Σacwm = 0]

(10 marks)

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School of Sport and Biological Sciences
Sport and Exercise Science Pathway
Sports Science and Coaching Pathway
Semester Two Examination 2018/19
Advanced Sport and Exercise Biomechanics
Module No. SPS6005

c) What is the muscular force required, from the Biceps Brachii, if the limb is being accelerated at 7.8 rad.s^{-2}?
[Formula 3: $\Sigma cwm + \Sigma acwm + I\alpha = 0$; Formula 4: $I = I_{CG} + mk^2$]

(10 marks)

d) As a percentage, how much more of dynamic force is required compared to static force in the two situations above? How will this lever system change through elbow flexion motion?

(5 marks)

Section B: Experimental

Answer TWO questions from this section.

COMPULSORY QUESTION

2.

a) What is Electromyography (EMG), what does the raw EMG signal from the muscle represent and what process does this raw signal have to follow from detection through to observation on software?

(8 marks)

b) With reference to the literature, explain the different methods of processing EMG signal.

(15 marks)

c) Outline an experiment, using EMG, to investigate the bilateral difference in muscle activity between dominant and non-dominant limb Vastus Lateralis muscles in 10-RM (repetition maximum) back squat and front squat exercises. Consider data collection, data processing, normalisation, and indicate your anticipated/ hypothesised results.

(20 marks)

d) Explain the importance of sampling and processing (filtering or smoothing) data at the correct frequency. In your answer, you should consider the difference between EMG and other methods of biomechanical assessment.

(7 marks)

School of Sport and Biological Sciences
Sport and Exercise Science Pathway
Sports Science and Coaching Pathway
Semester Two Examination 2018/19
Advanced Sport and Exercise Biomechanics
Module No. SPS6005

CHOICE QUESTIONS

Choose ONE of the following questions to answer.

3. Outline an experiment, using an Isokinetic Dynamometer, to assess the effects of a conditioning programme for a Quadriceps muscle group adaptation after a strength phase of training for a rugby player. Consider familiarisation, mode of contraction, speed in your data collection as well as appropriate data processing.

(20 marks)

OR

4. Outline an experiment, using 3D motion and integrated force plate analyses, to assess the knee kinetics and kinematics of a male football athlete in rehabilitation from an Anterior Cruciate Ligament (ACL) injury. Consider data collection, data processing and normalisation in your protocol.

(20 marks)

END OF QUESTIONS