Faculty of Engineering Science and the Built Environment

Department of Applied Science

LONDON SOUTH BANK UNIVERSITY

Session : 2010/11

Course No	Course Title Stream	Year Mode
1092	BSc (Hons) Sports Product Design 2FS00	2 FT
836	BSc (Hons) Sport and Exercise Science 2FS00	2 FT
3376	Fd to BSc Sport & Exercise Science top-up	1

Unit :	Biomechanics
Reference :	SES_5_202
Date :	21st January 2011
Time :	14.00
Time Available :	2 Hours

Instructions to Candidates

Answer questions in the answer book NOT on this question paper.

Section 1: Answer <u>ALL</u> questions.

Section 2: Answer <u>TWO</u> questions

Calculators may be used provided they are noiseless, cordless, not pre-programmed by the candidate and cannot receive or transmit data remotely.

Answer questions in the answer book **NOT** on this paper.

Section One: Answer all ten questions.

Section One: Definitions and short answers

1. Outline the equations for both linear and angular work defining each variable.
(5)

2. Outline and explain what is meant by the magnification of error when calculating Force from the impulse-momentum relationship based on kinematic data.
(6)

3. Outline the equations for linear and angular velocity and linear and angular acceleration (including units).
(6)

4. Explain what is meant by the term muscle tuning relative to GRF.
(4)

5. Explain what is meant by a piezoelectric substance and how does this relate to the Kistler Force Platform?
(5)

6. Explain the Stretch-Shortening Cycle with direct reference to the mechanical model of muscle illustration.
(5)

7. The following components of GRF were obtained for a 75kg individual:
V_{GRF}, 876 N, A/P_{GRF}, 380 N, M/L_{GRF}, 56 N
What is the magnitude of the resultant GRF acting on the individual in multiples of Body Weight?
(4)

8. Illustrate and formulate how the Kistler force platform uses moments to calculate point of force application (centre of pressure) when a load is applied to it.
(8)

9. Define the terms Kinetics and Kinematics and provide an example of internal kinetics, internal kinematics, external kinetics and external kinematics.

(4)

10. A high jumper applies a resultant force of 1850 N at take-off with a projection angle of 57° to the horizontal. What is the vertical component of this take-off force?

(3)

Section Two: Answer TWO questions. Each question is worth 25 marks.

Question One

(i). Sequential motion is an important aspect of human athletic performance. Explain what is meant by sequential motion and illustrate and explain a linear velocity–time graph of efficient and inefficient sequential profiling in a kicking action.

(10)

(ii). Describe in detail how a two-dimensional motion analysis of kicking would be performed relative to the kicking extremity (include kinetogram representation at important instants of performance).

(15)

Question Two

External force plays a critical role in enabling progression in human gait.

(i). Illustrate and describe the GRF resultant force vector at instants of initial contact, mid-stance and toe-off during walking.

(7.5)

(ii). Describe the Kistler force platform instrumentation used to record the forces in walking and illustrate and explain a typical Force-time curve.

(17.5)

....turn over for Question Three

Question Three

Theories of self-optimisation indicate that the human system continually strives for mechanical efficiency through the co-ordination and activation of neuromechanical pathways. Efficient and effective muscular recruitment patterns are a critical component of this process.

(i) Outline the procedures undertaken when using electromyographic instrumentation to quantify the muscular profile in a sporting action.

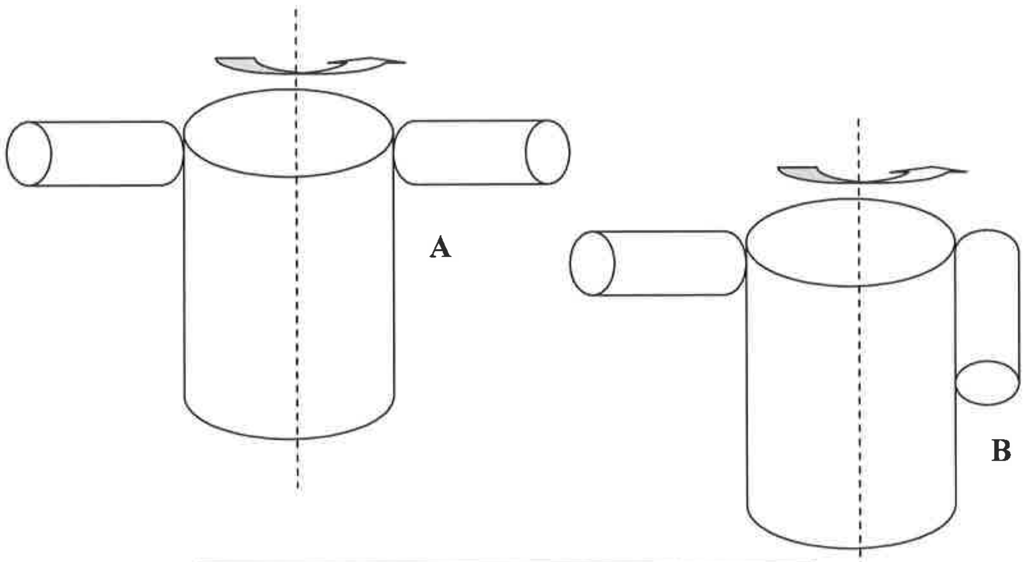
(15)

(ii). To enhance efficiency in rotational motion it is important for the human system to reduce overall resistance to rotation.

Calculate the overall moment of inertia specific to the geometric models A and B when rotating about the longitudinal axis of the trunk. Explain your results.

(Refer to Appendix A for geometric equations).

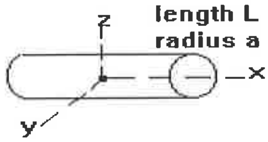
(10)



Body Mass = 82kg, Mass of arms = 3% BM
Right arm length = 0.97m
Left arm length = 0.95m
Radius of both arm cylinders = 0.04m
Radius of trunk cylinder = 0.37m

Appendix A

Cylinder



$I_x = 1/2\ m\ .\ a^2$

$I_y =$

$\quad \}\ 1/12\ m(3a^2 + L^2)$

$I_z =$