*Faculty of Engineering Science and the Built Environment*

*Department of Applied Science*

LONDON SOUTH BANK UNIVERSITY

Session : 2009/10

| Course No | Course Title<br>Stream | Year<br>Mode |
|---|---|---|
| 2219 | BSc (Hons) Pre-Clinical Studies with Sport & Exercise Science<br>1FS00 | 1 |
| 1092 | BSc (Hons) Sports Product Design<br>4FS00 | 3 |
| 836 | BSc (Hons) Sport and Exercise Science<br>3FS00 | 3 |

**Unit :** Biomechanics 3

**Reference :** SSS_3_993

**Date :** 12th January 2010

**Time :** 10.00

**Time Available :** 3 Hours

## Instructions to Candidates

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

Answer **two** out of four questions.
Each question is worth 50 marks.

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

*Question One*

a. Previous findings have indicated that barefoot and shod gait is significantly different (Robbins & Hanna, 1986; Oeffinger *et al.*, 1999; Stacoff *et al.*, 2000; Nurse & Nigg, 2001; Rossi, 2003).

Discuss and explain the biomechanical differences in shod and barefoot conditions associated to the role of the foot gait.

(25)

b. Explain the role of functional variation and functional stability in relation to any gait cycle, giving examples throughout.

(10)

c. Explain how alterations associated to pathological characteristics of gait may change kinematic and kinetic variables, outlining the importance of each variable provide examples throughout.

(15)

*Question Two*

a. Define load and explain its role in the development, adaptation and tolerance of the human musculoskeletal system

(10)

b. Explain the role of inverse dynamics in calculating joint load and describe the process by which this is achieved

(15)

c. Discuss and explain what is meant by the term "modelling" with direct reference to the mechanical process of human motion.

(15)

c. Illustrate and explain the mechanical model of muscle. Outline the change in the properties of this model associated to age.

(10)

*Question Three*

The knee joint plays an important role in force attenuation and as such knee stability is a primary concern in relation to injury. Stability of this joint is provided by the complex interactions of a many factors, including muscle, ligament and cartilage.

a. Outline and explain the mechanical features and considerations associated with the stabilising structures of the knee joint in relation to load.

(30)

b. Illustrate and explain the mechanical effects associated to excessive tightness in the Iliotibial band

(10)

c. Discuss the characteristics of unorthodox movements in relation to effects on the knee structure and interaction with ground surfaces.

(10)

*Question Four*

The integration of the kinetic and kinematic branches of biomechanics is critical when analysing human performance.

a. Discuss and explain the mechanical considerations of each of the following variables in relation to the analysis of human movement, providing examples throughout.

- Kinematic data.
- Inertia properties of the segments and their centres of mass
- Joint centres of rotation
- Directly measured forces

(25)

b. Explain the importance of segmental contribution in human motion, providing example and illustrations.

(10)

c. Pronation and Supination of the foot / ankle structure during ground contact requires distinct segmental interactions. Define the two terms and outline the mechanical actions of the foot during load response in walking.

(15)