NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

SSC2104

FACULTY OF APPLIED SCIENCES

BACHELOR OF SCIENCE HONOURS DEGREE EXAMINATIONS

DEPARTMENT OF SPORTS SCIENCE AND COACHING

THEORY: SSC2104: BIOMECHANICS

JANUARY 2011

3 HOURS (100 MARKS)

INSTRUCTIONS

Answer 4 questions only. Each question carries 25 marks. Where a question contains subdivisions, the mark value for each subdivision is given in brackets. Illustrate your answer where appropriate with large clearly labeled diagrams.

1) a) In biomechanics, what is a quantitative analysis? [5 marks]

b) Use a dimensional analysis to determine the units of the following kinematic parameters:-

i) Speed.
ii) Position.
iii) Velocity.
iv) Acceleration. [10 marks]

c) Suppose an individual moves from point $S_1(3, 5)$ to $S_2(6, 8)$. Find out the following displacements:-

i) Horizontal.
ii) Vertical.
iii) Resultant. [10 marks]

2) a) Calculate velocity and acceleration given the following (using First central method):-

FRAME	TIME (S)	POSITION (M)
4	0,020	1,034
5	0,025	1,041
6	0,030	1,050
7	0,035	1,041
8	0,040	1,044

[10 marks]

b) A shot putter releases the shot at an angle of 40^0 from a height of 2.2m with a velocity of 13.3 m/s. Calculate the range of the shot. [9 marks]

c) A cyclist completes 2,1 cycle revolutions in 1s. What is:-
   i) The angular distance.
   ii) The angular displacement.
   iii) The angular velocity. [6 marks]

3) a) Using sporting examples outline the relationship between linear velocity and angular velocity. [10 marks]

b) Explain why a batter in baseball would wish to "choke up" on a bat when facing a pitcher with an outstanding fastball. [15 marks]

4) a) What are the coefficient of friction if the friction forces are:-
   i) 80,9N
   ii) 25,7N
   iii) 100N and normal force 110N [10 marks]

b) Outline Fluid Resistance as a force.. [5 marks]

c) Describe the two properties of a fluid that most affects objects as they pass through it. [10 marks]

5) a) Explain the diver's movements in completing a $1^1/_2$ somersault dive in terms of their moment of inertia and angular velocity (use diagram). [15 marks]

b) What is the moment of inertia of a segment about a transverse axis through centre of mass with length of 0,43m, a mass of 3,7kg and radius of gyration (segment length) of 0,302. [5 marks]

c) If a force of 200N acting 0,34m from axis of rotation is balanced by another force of 185N. What is the moment arm of second force. [5 marks]

6) a) Using examples outline angular analog to Newton's Second Law of motion. [10 marks]

b) Describe force couple and how it is used in gymnastics. [10 marks]

c) In the construction of a lever which are the three situations that may arise that define the function of the lever. [5 marks]

END OF EXAMINATION