

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

DECEMBER 2005

3 HOURS (100 MARKS)

INSTRUCTIONS

Answer any four questions only.

1. a) Using sporting examples and mathematical formulas, discuss the relationships between the following:
- (i) Linear displacement and Angular displacement. (5 marks)
 - (ii) Linear velocity and Angular velocity. (5 marks)
 - (iii) Linear acceleration and Angular acceleration. (5 marks)
- b) Briefly discuss the factors that can influence the height and length of the trajectory of a projectile. (10 marks)
2. a) Suppose you shoot a ball straight up at 40m/s, find
- (i) Its vertical velocity after 0.5s.
 - (ii) Time to get to the peak.
 - (iii) The peak height. (10 mark)
- b) A slater completes a double twisting jump followed by a triple twisting jump.
- (i) How many revolutions were completed at each jump? (2 marks)
 - (ii) What was the angular distance in degrees and radians for each jump? (3 marks)
 - (iii) What was the Angular displacement? (3 marks)
- c) During the support phase of running the absolute angle of the thigh has the following angular velocities.
- | Frame | Time | Angular Velocity rad/s |
|-------|--------|------------------------|
| 38 | 0.6167 | 1.033 |
| 39 | 0.6333 | 1.511 |
| 40 | 0.6500 | 1.882 |
| 41 | 0.6667 | 2.190 |
- Calculate the angular acceleration at frames 39 and 40. (7 marks)
3. a) Briefly discuss the characteristics of force. (5 marks)
- b) Using sporting examples, discuss the 4 types of contact forces and how each affects human movement. (4 x 5 marks)

4. State the Angular Analog to Newton's 1st, 2nd and 3rd law of motion and their impact on human movement. (25 marks)
5. a) Describe the changes which might take place on the following parameters when a diver or gymnast is completing an arial somersault.
(i) Angular momentum
(ii) Moment of inertia
(iii) Angular velocity. (20 marks)
- b) A football player pushes a 90kg tackling sled. The coefficient of static friction between sled and grass is 0.69 and coefficient of sliding friction between the sled and grass is 0.58. Find: How much force the player must exert to get the sled in motion. How much force is required to keep the sled in motion. (5 marks)
6. a) Briefly discuss Torque and its characteristics. (7 marks)
- b) Using examples of human muscles, discuss the relationship between torque, mechanical angular work and angular power. (18 marks)

END OF EXAMINATION QUESTION PAPER