UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For the following qualifications:

B.Sc. (Intercal)

HEALTH SCIENCES C104: BIOMECHANICS

COURSE CODE	:	**HESCC104**
UNIT VALUE	:	**0.50**
DATE	:	**12 May 2003**
TIME	:	**10. 00 am**
TIME ALLOWED	:	**3 hours**

HEALTH SCIENCES C104: BIOMECHANICS

Answer FOUR QUESTIONS:

Answer EACH question in a SEPARATE book

1. The force acting across the knee joint depends on:

   i) the magnitude and distribution of the masses of the various body parts
   ii) the relative positions of the body parts
   iii) the movements of those same body parts relative to each other and to the ground.

   a) Describe, for a particular movement of the knee, how these three types of data may be obtained and how they are analysed to estimate the forces in the joint.

   b) Explain carefully what assumptions have to be made in carrying out the analysis and why the calculated result can only be an estimate.

2. Cartilage is described as a biphasic, visco-elastic, porous, hydrated material.

   Explain how these properties are able to account for the performance of articular cartilage in everyday activities.

3. Wear induced osteolysis can be attributed to both mechanical and biological effects. Describe the mechanical mechanisms that play a role in aseptic osteolysis

4. Describe the biological response to the 3 commonly used metals in joint replacement. Your answer should include local, systemic and toxicological effects.

5. Mechanics of the skin:

   a) Describe an experiment to measure the rheological properties of the skin on the soles of the feet;

   b) Devise and describe the apparatus, explain the principle of operation, and define the measured parameters;

   c) Using invented data, calculate the elastic and viscous components of a suitable viscoelastic model. Explain any assumptions and limitations.

6. Bone fractures are common. The methods you use to treat them will affect fracture healing and patients' quality of life.

   a) Define rapid fracture and stress fracture, and describe their association
   b) with strain energy and fracture type.

   c) When a long bone fractures, how does the inter-fragmentary strain and micromotion affect fracture union?

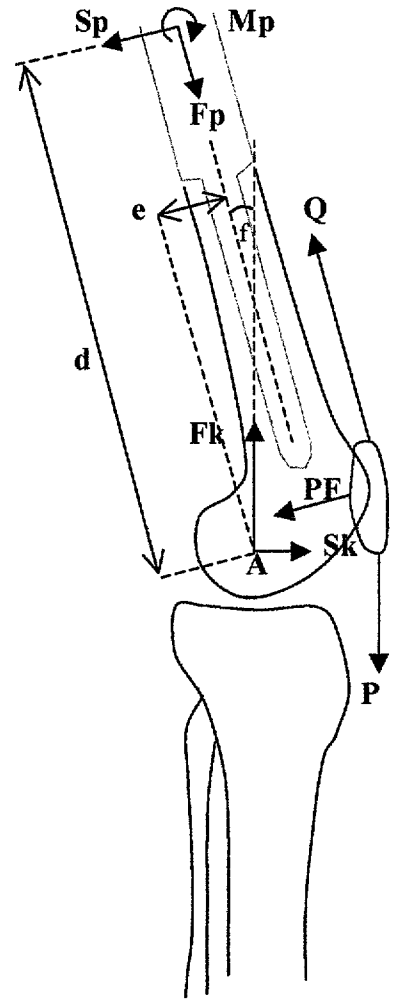
   d) Based on your biomechanical understanding, how would you treat transverse fracture in a long bone and why?

7. a) Outline possible biomechanical applications for information that has been obtained on forces acting on skeletal structures *in vivo*.

b) State the merits and drawbacks of using either mathematical skeletal models or instrumented implants, for deriving the data defined in a). Refer to degree of invasiveness, risks, and accuracy of measurement.

c) The diagram shows a possible force system acting on the patella. Assuming the quadriceps force Q acts parallel to the femoral shaft, the patellar tendon force T acts parallel to the tibial shaft, and the patello-femoral force P acts at 90° to the femoral shaft, draw a simple vector diagram for this force system for a flexion angle of 25°.

If P = 400N, calculate Q and T
[Take sin25° = 0.4, cos25° = 0.9]



d) Describe briefly how you would develop a finite element model of the patella and how you would check for accuracy of results. What results might be obtained from this model?

END OF PAPER