1. (70%) A femoral component of a total hip prosthesis is under bench test, as shown in the following figure. A vertical load of 500kg is applied through the head. Calculate the maximum tensile and compressive stresses developed as section A-A'. The cross-sectional geometry and the area moment of inertia of the stem at A-A' is also given as shown. In calculating the stresses, please consider both axial loading and bending conditions.

Area = 4cm2

I_{zz} = 1.5cm4

In axial loading :

$$\text{stress} = \frac{\text{load}}{\text{area}}$$

In bending :

$$\text{stress} = \frac{MC}{I_{zz}}$$

M = bending moment.

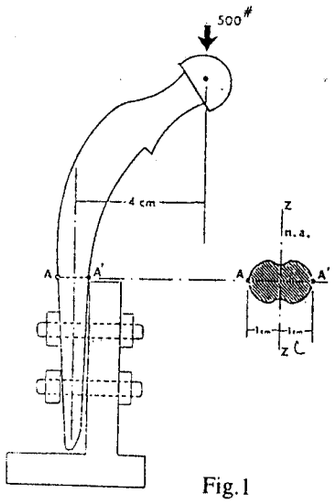

Fig.1

2. (10%) Fig. 2-a, Fig. 2-b are two Cases of bone-ligament failures Problem.

(a) In what Loading Condition will the failure Occur as Shown in Fig. 2-a and in Fig. 2-b.

(b) Explain those phenomena from biomechanical point of View.

Fig.2-a

Fig. 2-b

3. (10%) Fig. 3-a and Fig. 3-b are two Cases of bone fracture under torsion.

(a) In What Loading Condition Will the fracture Occur as Shown in Fig. 3-a and Fig. 3-b.

(b) Explain those phenomena from biomechanical point of View.

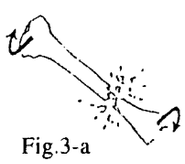

Fig.3-a

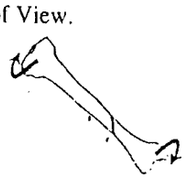

Fig.3-b

4. (20%) (a) Define the term "Center of Rotation".

(b) Find the Instant Center of a Knee Joint. If an infinitesimal displacement takes place from (X,Y) to (X_1,Y_1) as Shown in Fig.4.

(c) From the Concept of instant rotating Center, define (1) Rolling Motion (2) Sliding Motion.

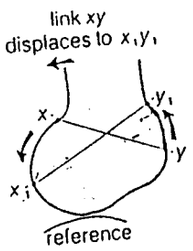

Fig.4

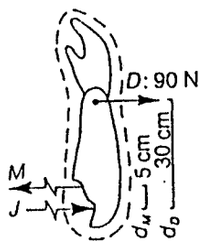

Fig.5

5. (20%) As Shown in Fig.5 the dynamometer force D=90N is applied 30cm from the elbow joint. Calculate the muscle force M and Joint reaction force J.

6. (20%) Describe the function of Shoulder joint from (a) Anatomical (b) Biomechanical point of View.