

EASTERN UNIVERSITY, SRI LANKA

FIRST EXAMINATION IN SCIENCE – 2013/2014

FIRST SEMESTER (PROPER/REPEAT)

(October 2015)

PH 105 GENERAL PHYSICS



Time: 01 hour

Answer ALL Questions.

Briefly explain the terms *stress* and *strain* when an external force is applied to an elastic material.

Find the stress on a bone (1 cm in radius and 50 cm long) that supports a mass of 100 kg. Find the strain on the bone if it is compressed 0.15 mm by this weight. Find the proportionality constant k for this bone.

Define *moment of a force*.

Figure 1 is a diagram of a human arm lifting an object. The lower arm is horizontal and its centre of gravity is 0.150 m from the elbow joint. The weight of the lower arm is 18 N. The biceps muscle exerts a vertical force F on the arm. The horizontal distance between the elbow joint and the point of the attachment of the muscle to the lower arm bone is 0.040 m. The weight of the object held in the hand is 30 N and its centre of gravity is 0.460 m from the elbow joint. The arm is in equilibrium.

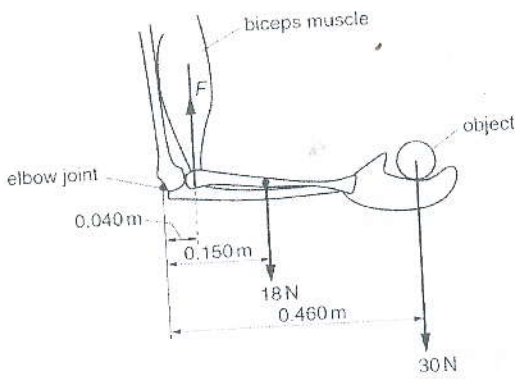


Figure 1

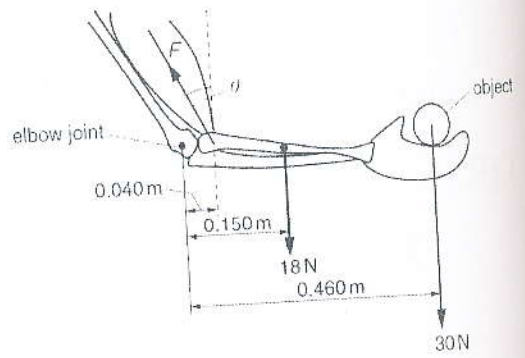


Figure 2

Calculate the total clockwise moment about the elbow joint shown in Figure 1.

As the lower arm is moved away from the body, the force F exerted by the biceps muscle acts an angle θ to the vertical as shown in Figure 2. The lower arm remains horizontal and in equilibrium. Determine

- i. the anticlockwise moment about the elbow joint and
- ii. the magnitude of the force F .

02. Differentiate between *streamline flow* from *turbulent flow* in fluid mechanics.

Obtain Poiseuille's equation for a viscous fluid flowing through a narrow tube of radius r and length l . State clearly the assumptions that you made in the derivation of the equation.

If a spherical bob of radius a and density σ is allowed to move at a velocity v through the same fluid of viscosity η and density ρ , show that the terminal velocity v_T is given by

$$v_T = \frac{(\sigma - \rho)vg}{6\pi\eta a}$$

A steel bob of radius 6 mm is freely falling in a transparent vessel of glycerine. The densities of steel and glycerine are 8500 kgm^{-3} and 1320 kgm^{-3} respectively. The viscosity of glycerine is 0.83 Nsm^{-2} , calculate the terminal velocity of the bob.