⑧⑨學年度 國立成功大學 碩士班招生考試 醫學工程研究 系所 材料力學 甲組選考科目 試題 共 / 頁 第 / 頁

1. What is "Pure Moment"? Explain and design an experiment in detail to create pure moment on a prismatic bar. (10%)
2. Give the definitions of the following terms. (20%)
   1) elastic& plastic, 2) homogenous, 3) isotropic, 4) Poisson's ratio, 5) "buckling" of a column.
3. Design at least two experimental methods to determine the modulus of elasticity of a beam element. (10%)
4. A steel shaft and an aluminum tube (Fig. 4) are connected to a fixed support and to a rigid disk as shown in the cross section. Knowing that the initial stresses are zero, determine the maximum torque T_0 which may be applied to the disk if the allowable stresses are 120 MPa in the steel shaft and 70 MPa in the aluminum tube. Use G = 80 GPa for the steel and G = 27 GPa for aluminum. (G : shear modulus of elasticity) (20%)
5. A rough sketch of a human femur subjected to a vertical load of 400 N is shown in Fig. 5. (a) determine the distribution of stress across the section BB assuming that the circular section is solid bone. (b) Same as (a), except that this time assume that the inner half of the bone radius consists of "spongy" bone which does not carry appreciable stress. (c) What is the percentage increase in the maximum stress of distribution (b) compared with the maximum stress of distribution (a)? (20%)
6. Gas pressure (P) in a soap bubble is related to the surface tension σ and the radius R by the equation $P = 4\sigma/R$. Derive the equation.
   Take a pippette, put a valve in the middle, close it, and blow two bubbles, one at each end; One bubble is large and one is small. Now open the middle valve so that the gas in the two bubbles can move into each other. In which way will the bubble diameters change? Explain in detail. (shown as Fig. 6) (20%)

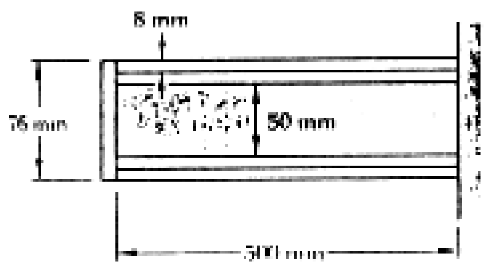

Fig. 4

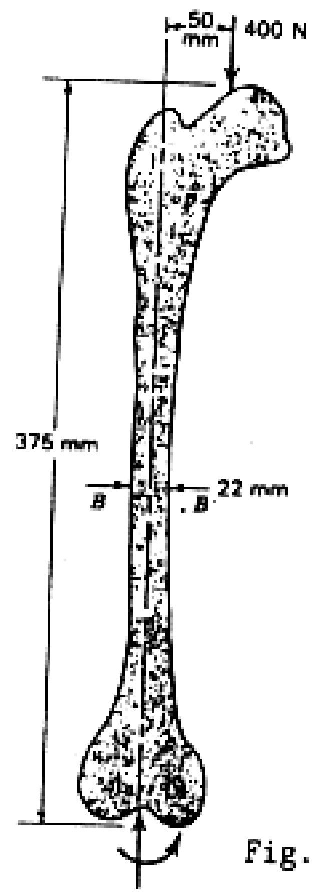

Fig. 5

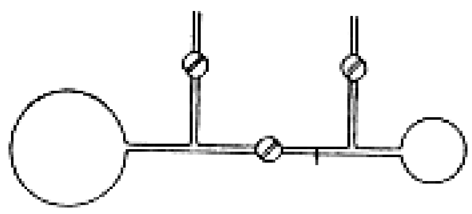

Fig. 6

227002B