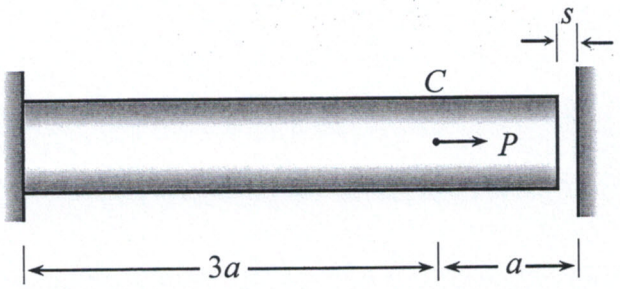
國立交通大學 104 學年度碩士班考試入學試題

科目：材料力學(3031)　　考試日期:104 年 2 月 7 日 第 2 節

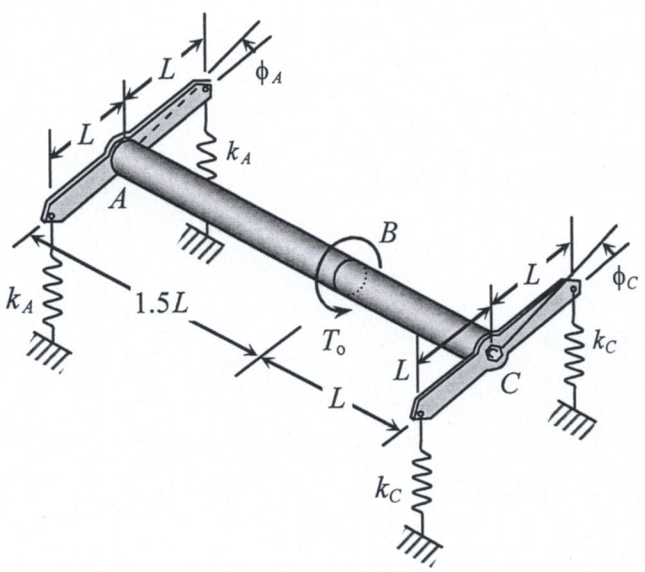
系所班別：機械工程學系　　組別：機械系丙組　　第 1 頁,共 2 頁

【可使用計算機】＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符！！

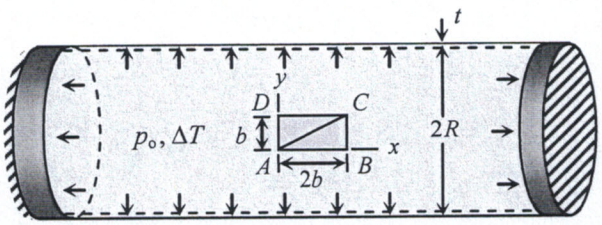
1. Before the load is applied to point C there exists a small gap s (between the right end of the bar and a rigid wall) as indicated in the figure. The bar has Young's modulus E and cross-sectional area A. Assume that $s << a$.
   (a) Determine the value of P such that the gap is just closed (i.e. it is closed but there is no contact force acting between the right end of the bar and the rigid wall) – denote this value P_C. (5%)
   (b) Determine the wall reactions for loads when $P > P_C$. (10%)
   (c) Determine the displacement of point C when $P > P_C$. (5%)



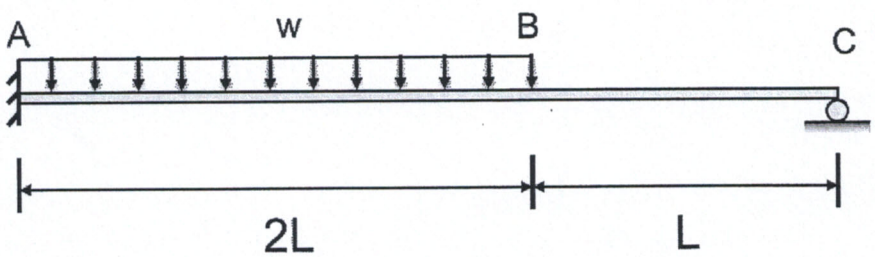
2. An elastic circular shaft of length $2.5L$ is supported by two sets of linear springs at both ends A and C. The shaft has uniform torsional rigidity GI_P. The spring constants are $k_A = 3GI_P/L^3$ and $k_C = 2GI_P/L^3$, respectively. They are not stretched before a torque T_o is applied at point B. Both ends of the shaft are assumed to rotate through small angles.
   (a) Determine the angles of twist ϕ_A, ϕ_B, and ϕ_C due to the applying torque. (16%)
   (b) What portion will yield first if the applying torque continues increasing? (4%)



3. A rectangular element *ABCD* is drawn on the outer surface of the cylindrical portion of a thin-wall pressure vessel of mean radius *R* and a wall thickness *t* as shown. The initial dimensions of the element are $2b \times b$. This cylindrical pressure vessel is adhered to two rigid walls at its ends and is initially free of stress. Consider the vessel is subjected to an internal pressure p_o and a temperature rise ΔT. As a result of deformation the rectangular element becomes $A^*B^*C^*D^*$. The material constants and the coefficient of thermal expansion are *E*, ν and α. Determine the diagonal length A^*C^* of the deformed element in terms of p_o, ΔT, *E*, ν, α, *R*, *t*, and *b*. (20%)



4. Please calculate the transverse deflection (at **point B**) and the end slope (at **point C**) of the beam shown in the figure. The beam is subjected to the uniformly distributed load w within the span of AB. Assume the beam is linearly elastic and EI is constant. (20%)



5. A cantilever beam of T section is loaded by an inclined force of magnitude 30kN as shown in the figure. The line of action of the force is inclined at an angle of 45 degree to the vertical and intersects the top of the beam at the end cross section. The beam is 3m long, and the cross section has the dimensions shown in the figure. Please calculate the principal stresses at point A in the web of the beam. (20%)