

國立臺北科技大學 100 學年度碩士班招生考試

系所組別：1202 製造科技研究所

第二節 材料力學 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共四題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (25%) A steel bolt of length $L=12$ in. passes through a copper sleeve of the same length, as shown in Fig.1, and the nut is turned up just snug at temperature $T = 70^\circ\text{F}$. Subsequently the nut is tightened up $n = 1/2$ turn and the entire assembly is raised to a temperature $T=140^\circ\text{F}$. What stresses will exist in the bolt and the sleeve? The cross-sectional area of the steel bolt is $A_s = 1/2$ sq in., its modulus of elasticity $E_s = 30(10)^6$ psi, the coefficient of thermal expansion is $\alpha_s = 6.5(10)^{-6}$ in./in./ F° and the thread pitch $p = 1/8$ in.. For the copper sleeve, $A_c = 3/4$ sq in., $E_c = 16(10)^6$ psi, and $\alpha_c = 9.3(10)^{-6}$ in./in./ F° .

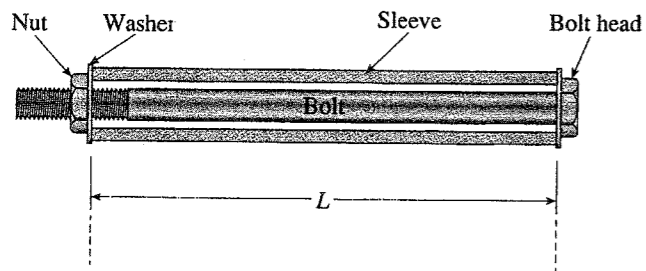


Fig.1

2. (25%) A solid circular bar ABCD with fixed supports is acted upon by torques T_0 and $2T_0$ at the locations shown in the Fig.2. Find : (a) the reactions at ends A and D. (b) the maximum angle of twist of the bar.

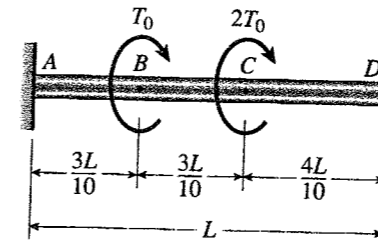


Fig.2

3. (25%) A simple supported composite beam 3 meter long carries a uniformly distributed load of intensity $q = 6.0$ kN/m (see Fig.3). The beam is constructed of a wood member, 100 mm wide by 150 mm deep, reinforced on its lower side by a steel plate 8 mm thick and 100 mm wide. Find the maximum bending stresses in the wood and steel, if the moduli of elasticity are $E_w = 10$ GPa for the wood and $E_s = 200$ GPa for the steel.

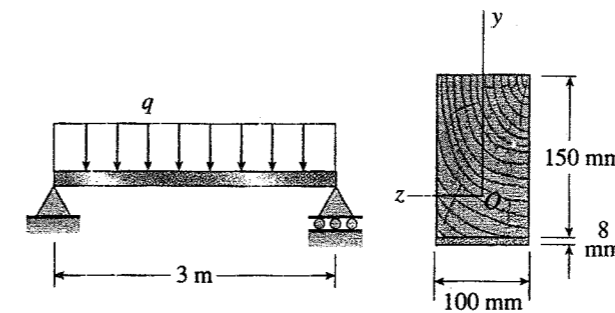


Fig.3

4. (25%) A plane stress element is subjected to stress $\sigma_x = 6500$ psi and $\tau_{xy} = -2800$ psi (see Fig.4). It is known that one of the principal stresses equals 7300 psi in tension. (a) Determine the stress σ_y . (b) Determine the other principal stress and the orientation of the principal planes; then show the principal stresses on a sketch of a properly oriented element.

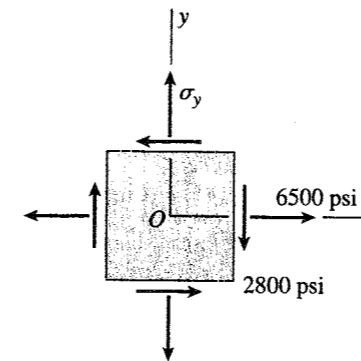


Fig.4