# 國立成功大學

# 115學年度碩士班招生考試試題

編　號：93

系　所：航空太空工程學系

科　目：材料力學

日　期：0203

節　次：第 1 節

注　意：1.不可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

1. (25%) The three A992 steel bars shown in Figure 1 are pin-connected to a rigid member. If the applied load on the member is 15 kN, determine the force developed in each bar. Bars *AB* and *EF* each have a cross-sectional area of 50 $mm^2$, and bar *CD* has a cross-sectional area of 30 $mm^2$.

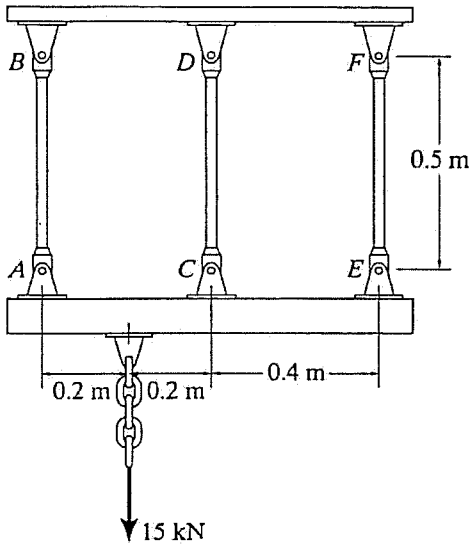


Figure 1

2. (25%) The tube is made of C86100 bronze and has a rectangular cross section as shown in Figure 2. If it is subjected to the two torques, determine the average shear stress in the tube at points *A* and *B*. Also, what is the angle of twist of end *C*? The tube is fixed at *E*.

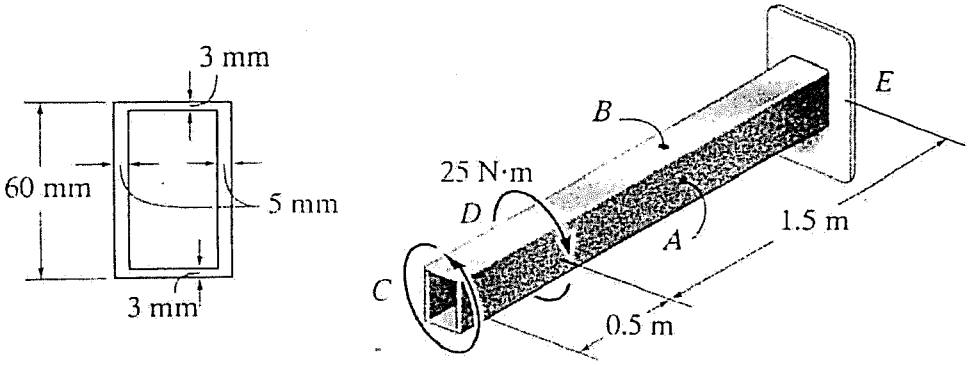


Figure 2

3. An element of the wing skin on an airplane is subjected to plane stress with normal stresses $\sigma_x = 120$ MPa in tension and $\sigma_y$ and shear stress $\tau_{xy}$, as shown in Figure 3. At an angle $\theta = -37°$ (i.e., 37° clockwise) from the $x$ axis, the normal stress remains 120 MPa in tension; while at a counterclockwise angle $\theta = 45°$, it becomes 55 MPa in compression. (Use $\cos 37° = 0.8$ and $\sin 37° = 0.6$ in your calculation.)

   (a) Determine the stresses $\sigma_y$ and $\tau_{xy}$ on this element. (10%)

   (b) Determine the principal stresses and maximum shear stress on this element. (5%)

   (c) Under the above stress condition, the strain gages measure the normal strains in the $x$ and $y$ directions as $\varepsilon_x = 0.0072$, $\varepsilon_y = -0.0058$. Determine the Young's modulus ($E$) and Poisson's ratio ($\nu$) for the material used on the wing skin. (10%)

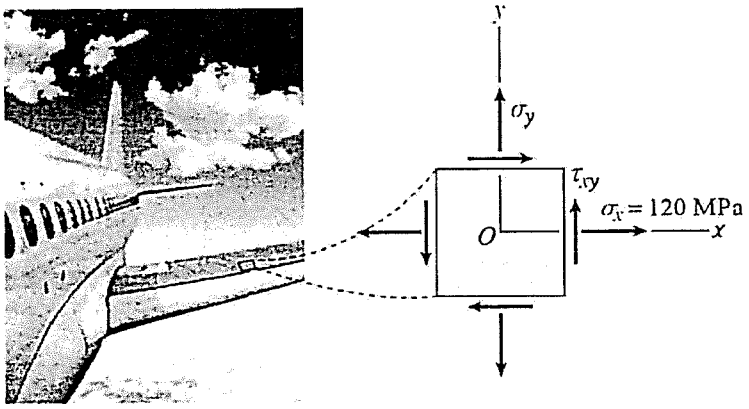


Figure 3

4. Consider the propped cantilever beam of length $2L$ with a roller support at $B$ subjected to a uniformly distributed load with intensity $q$, as shown in Figure 4. Assume that the flexural rigidity $EI$ is constant throughout the beam.

   (a) Determine all the reactions, $M_A$, $R_A$ and $R_B$. (10%)

   (b) Determine the shear force at $1.5L$ from the fixed support (the middle point between $B$ and $C$) (5%)

   (c) Determine the deflection at the right end $C$. (5%)

   (d) Find the maximum magnitude of bending moment and its location in the beam. (5%)

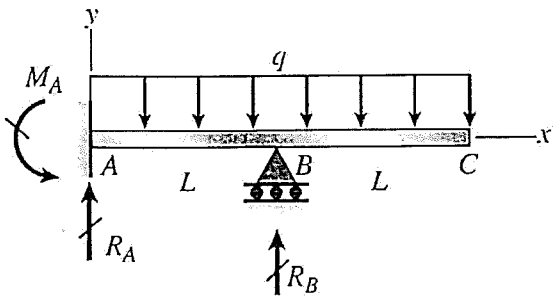


Figure 4