所別：機械工程學系碩士班甲、戊組　　科目：材料力學

1. 如 **Fig. 1** 所示，一個長 3 m，直徑為 30 mm 之圓形鋁桿(E = 70 GPa，ν = 0.346，α = 22.5 x 10^{-6}/°C)連接一壓縮彈簧(K = 100 N/mm)，此彈簧最多能容許 2 mm 之壓縮量。問當溫度上升 20 °C 時，此鋁桿之正向應力(normal stress)為多少?不需考慮彈簧之熱變形。**(25%)**

2. A steel beam is loaded and supported as shown in **Fig. 2**. The two segments of the beam are connected with a smooth pin at D. The section modulus of beam is S = 1200 x 10^3 mm^3.
(a) Draw complete shear force and bending moment diagrams for the beam. **(15%)**
(b) Determine the maximum tensile and compressive flexural stresses in the beam. **(10%)**

3. The two cantilever beams with cross section shown and separated by the gap *g*, are loaded as shown in **Fig. 3**. Determine the reaction between the beams. Take *g* = 0.1 in. and E = 2 x 10^6 psi. **(25%)**

4. As shown in **Fig. 4**, the solid steel shaft, 100 mm in diameter and 8 m long, is subjected simultaneously to an axial compressive force of 600 kN and a torque T that twists the shaft through 1.5°. If the shear modulus of steel is 80 GPa, find the maximum tensile, compressive, and shear stresses in the shaft and identify the working planes for these stresses. Show the results of these planes on a sketch of properly oriented elements in reference to the axial direction of the shaft. **(25%)**

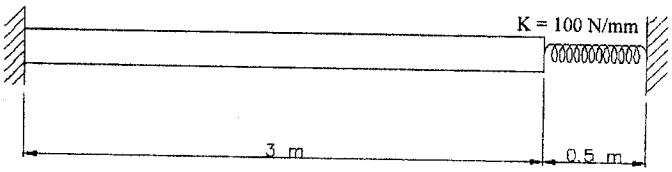

Fig. 1

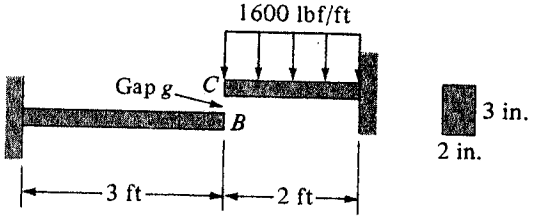

Fig. 3

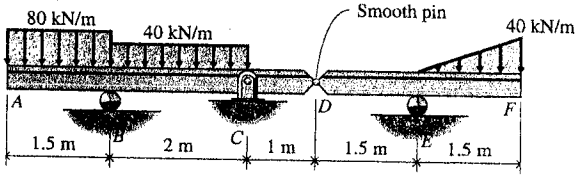

Fig. 2

參考用

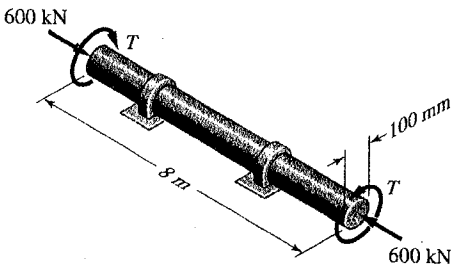

Fig. 4