1. 請繪製圖一所示結構系統中 A 點垂直反力 R_A，E 點固端彎矩 M_E，F 點剪力 V_F 之影響線圖。(B、D 為內鉸) (15%)

![圖一](image1)

2. 圖二所示之梁在 A、B、C 三支承處均有一動度為 k 之線性彈簧，梁之 EI 為定值且承受載重密度為 ω 之均佈載重，求梁中央 B 點支承所受之反力。(20%)

![圖二](image2)
3. For a loaded wide flange steel beam as shown (圖三), please find
(a) the bending and shearing stresses at point A,
(b) the directions and magnitudes of maximum and minimum principal stresses at point A,
(c) the orientations and magnitudes of the maximum shearing stress and the corresponding normal stress at point A 
(30%)

![Diagram of a loaded wide flange steel beam]

4. A rigid beam is constructed on supports B and C, and is suspended at D by a wire, as shown (圖四). If it is given that the support B has a stiffness \( k = 10 \text{ kN/m} \), the support C is rigid and the wire connected at D has a modulus of elasticity \( E = 200 \text{ MPa} \) and a cross-section area \( A = 1.0 \text{ cm}^2 \). Try to find the reactions at supports B, C and D as a uniform load \( q = 2 \text{ kN/m} \) is added on span CD. (20%)
5. The rigid frame (grid) shown in the following figure lies in a horizontal xy-plane. The load act vertically (parallel to the z-axis). Member ab and bc has the properties shown in the figure. Calculate the displacement at b. (15%)

Neglecting the axial deformations in all members

\[
\left( \frac{EI'}{L} \right)_{ab} = \left( \frac{EI'}{L} \right)_{bc} = \left( \frac{GJ}{L} \right)_{ab} = \left( \frac{GJ}{L} \right)_{bc} = 10^8 \text{kN/mm}
\]

xyz axes: global coordinate system  
x'y'z' axes: local coordinate system

圖五