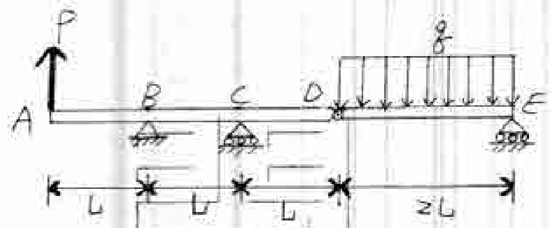
考生注意: 1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分，並限以藍黑色筆作答。
3. 試題隨卷繳回。(餘請詳閱試場規則)

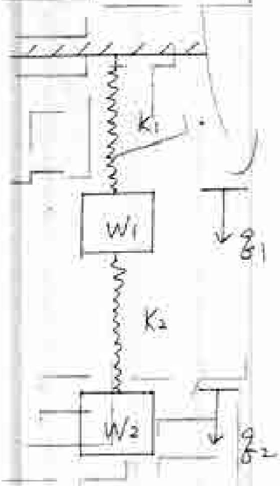
(1) The compound beam *ABCDE* shown in the *Figure* 1 consists of two beams (*AD* and *DE*) joined by a hinged connection at *D*. The hinge can transmit a shear force but not a bending moment. A force *P* acts upward at *A* and a uniform load of intensity *q* acts downward on beam *DE*. Draw the shear-force and bending-moment diagrams for the compound beam. [25%]

Figure 1



(2) Consider weights W_1 and W_2 supported by the linear springs as shown in *Figure* 2. The spring constants are k_1 and k_2. Determine the displacements q_1 and q_2 of the weights as functions of W_1, W_2, k_1, and k_2. Assume that the weights are applied slowly so that the system is always in equilibrium as the springs are stretched from their initially unstretched lengths. [25%]

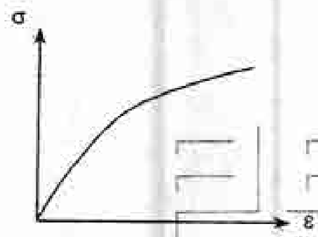
Figure 2



(3) The stress-strain diagram of an axial-loaded member is shown, and can be described by the equation $\varepsilon = 0.45(10^{-6})\sigma + 0.36(10^{-12})\sigma^3$, where σ is in kPa.

(a) Determine the yield strength assuming a 0.2% offset. (15%)

(b) Determine the elongation if the member is subjected to a tensile axial force of 2.5 kN; the cross section area and the length of the member are 25cm^2 and 100cm, respectively. (10%)



(4) A reinforced concrete beam was tested to failure and had a rectangular section: width b = 35 cm and depth d = 50 cm. At failure, the strain in the tension steel was recorded and was equal to 0.002615. The strain in the concrete at failure may be assumed to be 0.003. If f'_c = 210 kgf/cm^2 , f_y = 4200 kgf/cm^2 and the Young's modulus of steel $E_s = 2.04\times10^6$ kgf/cm^2 , (a) determine the steel area provided in the section to develop the above strains (15%); (b) determine the ultimate applied moment (10%). You must assume an equivalent *rectangular* compressive stress distribution and neglect the tensile stress of concrete at failure. The strength of the equivalent compressive region of concrete is 0.85f'_c, and the β_1 factor for evaluating the depth of the equivalent compressive region is 0.85 for f'_c = 210 kgf/cm^2.