

國立成功大學  
110學年度碩士班招生考試試題

編 號：96

系 所：土木工程學系

科 目：結構學

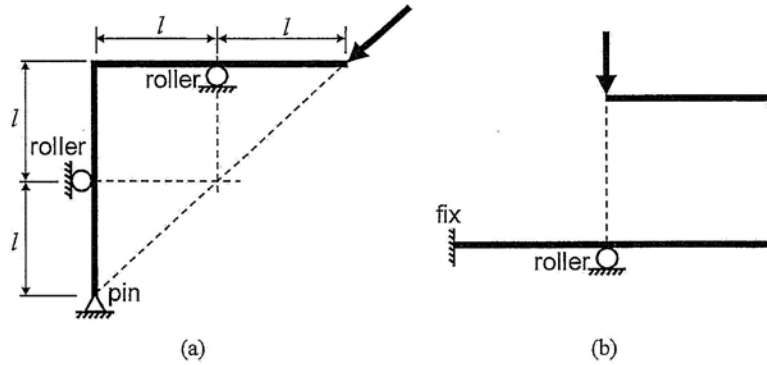
日 期：0202

節 次：第 2 節

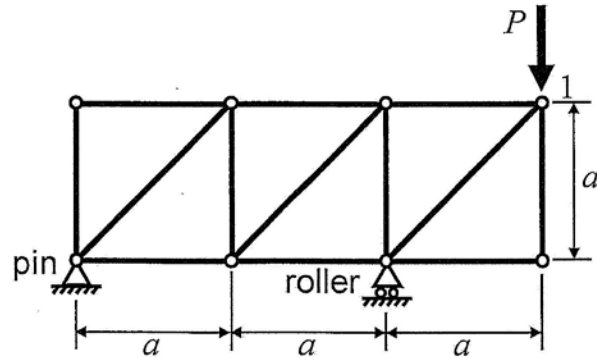
備 註：可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

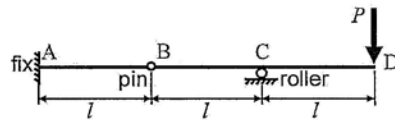
1. Draw bending moment diagram of the frames below: (10%, 10%)



2. The figure below shows a truss structure. Each member is pin-jointed and with axial stiffness of  $EA$ . Where  $E$  and  $A$  are the elastic modulus and cross-sectional area of the member, respectively. Estimate the axial force of each member and the vertical deflection at point 1 using  $P$ ,  $a$ , and  $EA$ . (25%)



3. Consider the beam elements shown in the figure below, each element has flexural rigidity of  $EI$  and the axial force effect is neglected. Compute (a) the deflection and rotations at point B by using conjugate beam method, and (b) deflection and rotation at point D by using unit force method. (12%, 12%)



4. Consider the truss system shown in the figure below, the cross-sectional areas of elements  $ab$ ,  $bc$ , and  $ac$  are  $600$ ,  $1000$ , and  $800 \text{ mm}^2$ , respectively. The elastic modulus  $E=200 \text{ GPa}$ .  $Q_1$ ,  $Q_2$ , and  $Q_3$  are the horizontal and vertical forces acting at point  $a$  and horizontal force acting at point  $b$ , respectively. The stiffness matrix of the system  $k$  can be expressed as follows:

$$\begin{bmatrix} Q_1 \\ Q_2 \\ Q_3 \end{bmatrix} = k \begin{bmatrix} q_1 \\ q_2 \\ q_3 \end{bmatrix}$$

where  $q_1$ ,  $q_2$ , and  $q_3$  are the horizontal and vertical displacements at point  $a$  and horizontal displacement at point  $b$ , respectively. (a) Use the principle of energy to compute matrix  $k$  in the unit of  $\text{kN/m}$ , and (b) compute  $q_1$ ,  $q_2$ ,  $q_3$  and member forces when  $Q_1=30\text{kN}$ ,  $Q_2=40\text{kN}$ , and  $Q_3=0$ . (20%, 11%)

