

本試題是否可以使用計算機： 可使用， 不可使用（請命題老師勾選）

考試日期：0301，節次：1

1. Explain briefly : (20%)
  - a. stress
  - b. strain
  - c. brittle materials
  - d. fatigue
  - e. creep
  
2. When the cylindrical coordinate( $r, \theta, z$ ) is used, what kind of shear strain is in the torsion of a circular shaft? (a.  $\gamma_{r\theta}$ , b.  $\gamma_{rz}$ , c.  $\gamma_{\theta z}$ ) According to the definition of shear strain, explain why you make the choice.(15%)
  
3. The bolt AB has a diameter of 20 mm and passes through a sleeve that has an inner diameter of 40 mm and an outer diameter of 50 mm. The bolt and sleeve are made of A-36 steel and are secured to the rigid brackets as shown. If the bolt length is 220 mm and the sleeve length is 200mm, determine the tension in the bolt when a force of 50 kN is applied to the brackets. (15%)

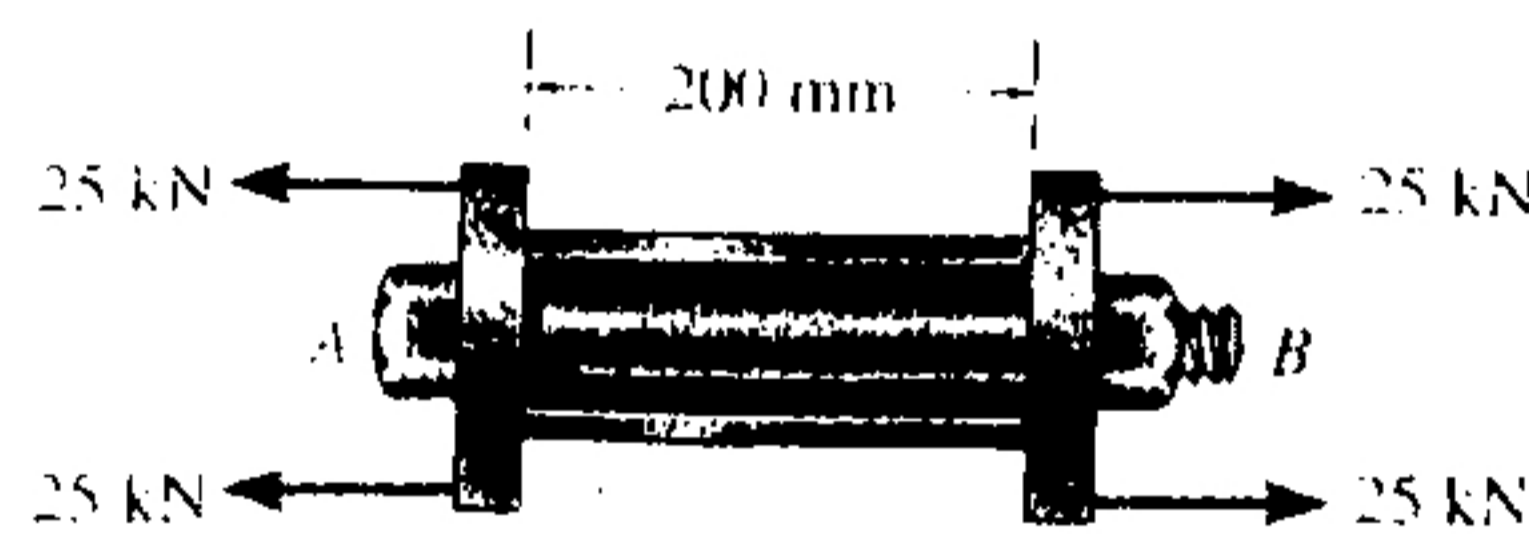


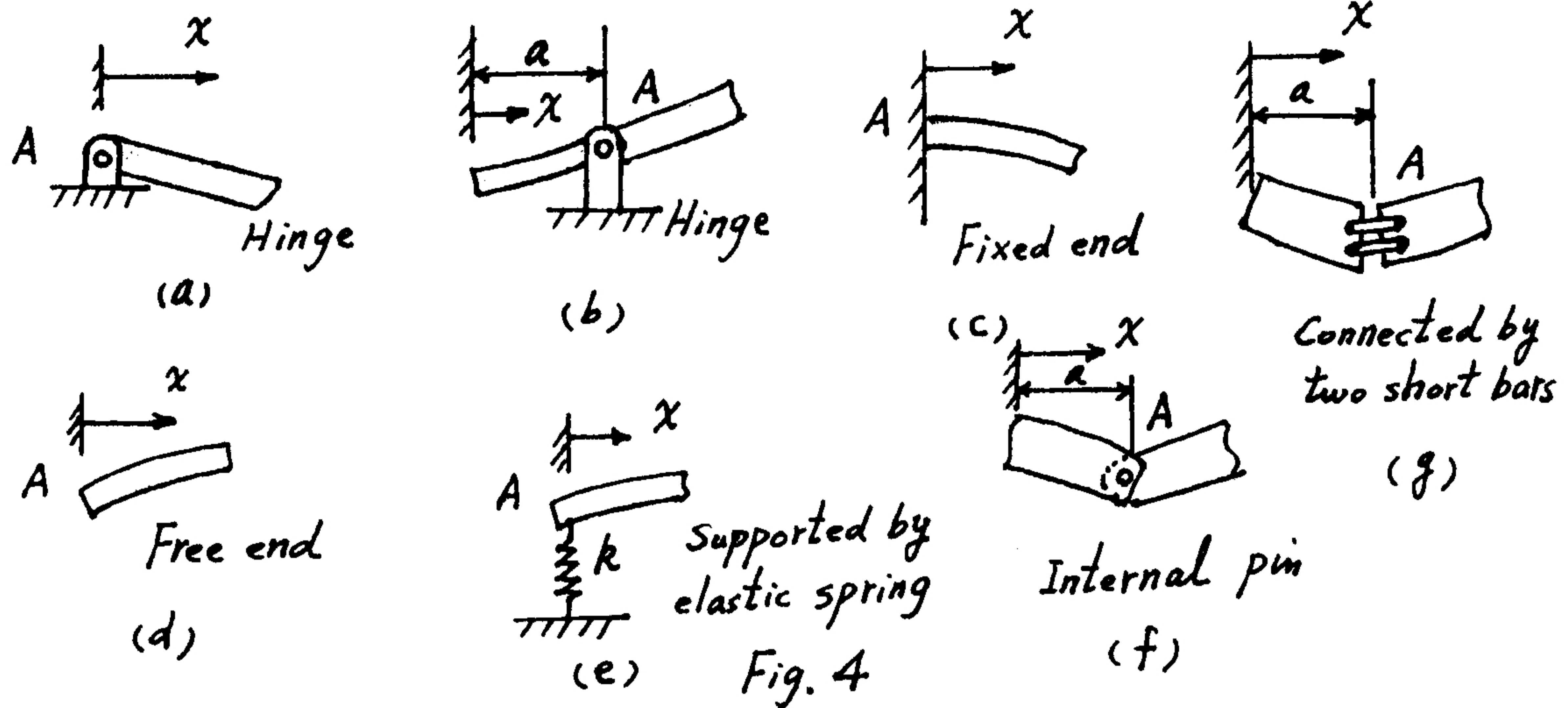
Fig. 3

4. If the deflection of a beam is determined by the 4<sup>th</sup> order ordinary differential equation:  $EI \frac{d^4 v}{dx^4} = -\omega(x)$ ; where  $\omega(x)$  is the distributed loading;  $EI$  is the flexural rigidity;  $v$  is the deflection;  $x$  is the coordinate along the axial direction. Write down the boundary condition of following supports and/or connections at point A, as shown in Fig. 4, in terms of  $EI$ ,  $v$  or its derivatives with respect to  $x$ : (14%)

(背面仍有題目,請繼續作答)

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5. A beam, having length  $L$  (m) with a rectangular cross section of height  $h$  and width  $b$  and subjected to a uniformly distributed loading  $w_0$  (N/m), as shown in Fig. 5, is supported by the fixed wall at A and a linearly elastic spring BC at B with spring constant  $k = 3EI/2L^3$  (N/m). If the spring is unstretched when the beam is not yet deformed,

- (5.1) determine the support reactions at points A and B; (6%)
- (5.2) plot the shear force and bending moment diagrams of the beam; (4%)
- (5.3) calculate the maximum bending normal stress, the maximum shear stress and the maximum deflection; (12%)
- (5.4) determine the deflection of the beam at point B by Castigliano's second theorem. (6%)

6. Determine the critical buckling load,  $P_{cr}$ , of the ideal column with pin supports, as shown in Fig. 6, by using the equation:  $EI \frac{d^2v}{dx^2} = M(x)$ ; where  $M(x)$  is the internal bending moment at cross section  $x$ . (8%)

