1. Explain briefly : (20%)
   a. stress
   b. strain
   c. brittle materials
   d. fatigue
   e. creep

2. When the cylindrical coordinate(r, θ, z) is used, what kind of shear strain is in the torsion of a circular shaft? (a. $\gamma_{r\theta}$ ， b.γ_{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%)

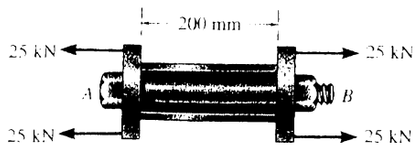

Fig. 3

4. If the deflection of a beam is determined by the 4th order ordinary differential equation: $EI\frac{d^4v}{dx^4} = -\omega(x)$; where ω(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)

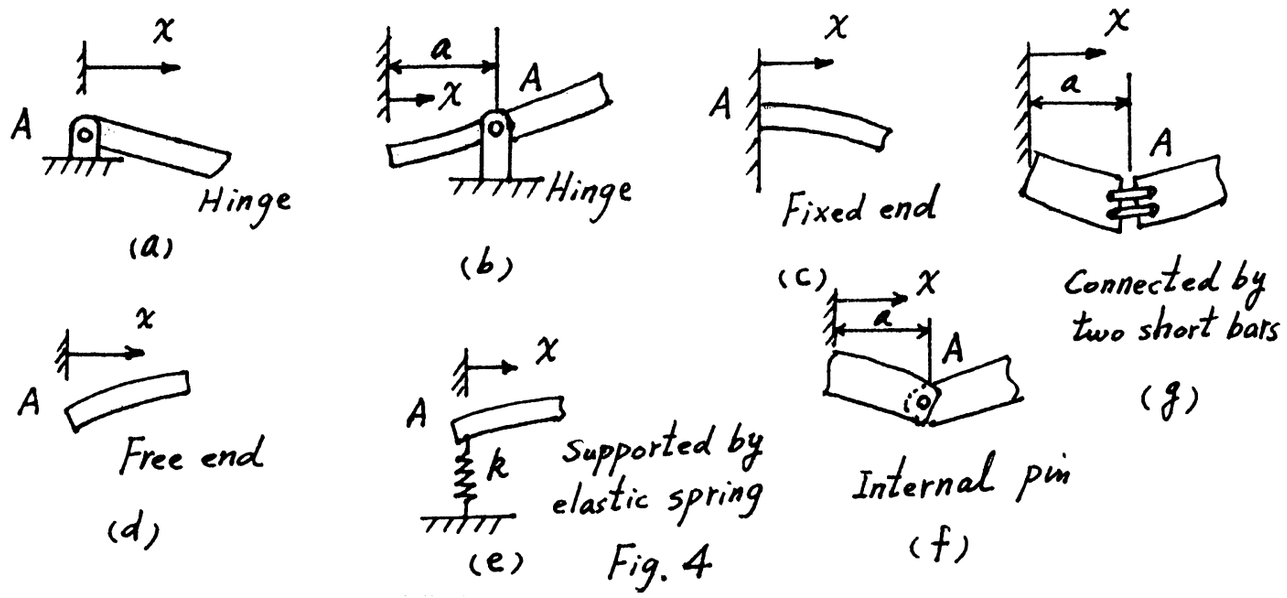

Fig. 4

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 ω_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: $EI\dfrac{d^2v}{dx^2} = M(x)$; where $M(x)$ is the internal bending moment at cross section x. (8%)

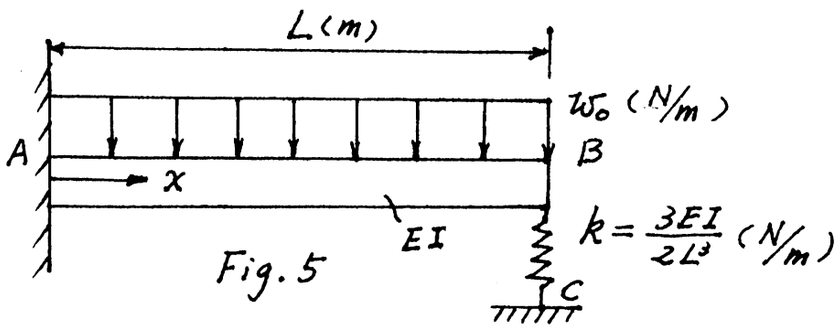

Fig. 5

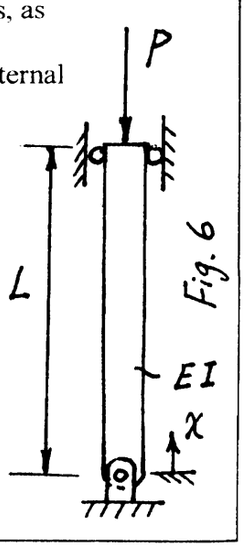

Fig. 6