

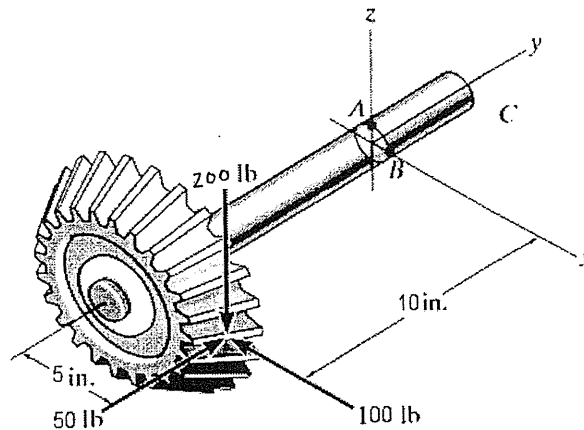
※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. 解釋或定義下列詞語

(a) shear strain. (b) brittle materials. (c) linear elastic material. (15%)

2. Explain (a) the principle of superposition, and list (b) the two conditions must be satisfied if the principle of superposition is to be applied. (10%)

3. The beveled gear is subjected to the loads shown below. Determine the stress components acting on the shaft at point B. The shaft has a diameter of 1 in. and is fixed to the wall at C. (25%)



4. The simply-supported beam as shown is subjected to axial compression P and distributed load w . The flexural rigidity of the beam is EI . (30%)

(a) Draw a free body diagram for a section of the beam and derive from the equilibrium condition to show that the governing equation for the transverse deflection v is given by (10%)

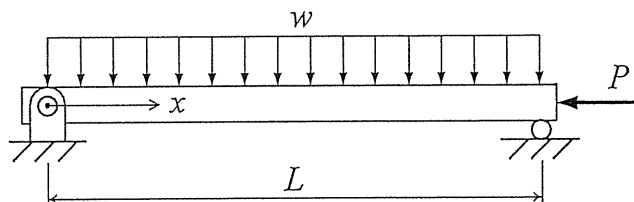
$$EI \frac{d^4 v}{dx^4} + P \frac{d^2 v}{dx^2} = -w.$$

(b) The general solution of the differential equation in (a) is given by

$$v = C_1 \cos\left(\sqrt{\frac{P}{EI}}x\right) + C_2 \sin\left(\sqrt{\frac{P}{EI}}x\right) + C_3 x + C_4 - \frac{w}{2P} x^2$$

Determine C_1, C_2, C_3 and C_4 . (16%)

(c) Would the beam buckle when the compressive load reaches a critical value? Show the buckling load P_{cr} if the answer is yes. (4%)



5. The ring as shown is subjected to a load P at top and is in frictionless contact with the floor. The flexural rigidity of the ring is EI . Determine the vertical displacement of the ring at point A by using Castigliano's second theorem (alternative solution approach is not allowed). (20%)

