※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

1. Define and/or explain the following terms briefly:
   a. Shear strain. (5%)
   b. Linear elastic material. (5%)
   c. Saint-Venant's principle. (5%)
   d. Shear center. (5%)

2. 下列各題敘述中，**至多有一處錯誤(連續字串少於 3 個單字)；請將錯誤敘述及更正之敘述寫於答案卷中；倘若題中敘述無錯誤，請寫 '無'.**

   a. For a beam having a rectangular cross section, the shear stress varies parabolically with depth. The maximum normal stress is along the neutral axis. (5%)

   b. For linear-elastic material the neutral axis passes through the centroid of the cross-sectional area. This conclusion is based on the fact that the resultant moment acting on the cross section must be zero. (5%)

   c. Normally the stress concentration in a ductile specimen that is subjected to a static loading will not have to be considered in design; however, if the material is brittle, then stress concentrations become important.(5%)

   d. Columns and beams are long slender members that are subject to axial loads. The critical load is the maximum axial load that a member can support when it is on the verge of buckling. (5%)

   e. Use of principle of superposition requires that the loading be linearly related to the stress or displacement, and the loading does not significantly change the original geometry of the member. (5%)

   f. A steel plate is subjected to two loads. If the magnitude of the two loads is doubled, then the magnitude of principal stresses will also be doubled, and the principle stress direction will be changed. (5%)

(背面仍有題目,請繼續作答)

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3. The given state of plane strain as shown in Fig. P3 is known to exist at a point in an elastic medium. Given that $E = 200$ GPa, $\nu = 0.3$, determine the principal stresses and strains. (12%)

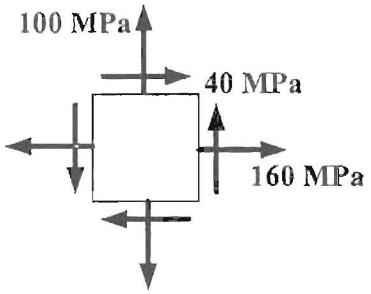

Fig. P3

4. Consider a pin-supported, initially slightly bent slender member subjected to an axial load P as shown in Fig. P4. The initial deflection profile of the member is given by $v_0(x) = \delta_0 \sin(\pi x/L)$. Flexural rigidity of the member is EI.
   (1) Derive for the deflection profile $v(x)$. (12%)
   (2) By using the results of (1), determine the critical value of P when buckling occurs. (6%)

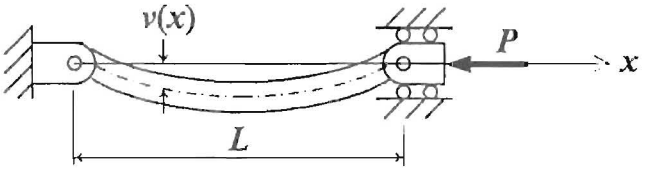

Fig. P4

5. Consider the hook as shown in Fig. P5 subjected to a load P at point A. The hook has a circular cross-section of radius r, $r << R$. Young's modulus of the hook is E. Determine the vertical and horizontal displacements of point A by using Castigliano's theorem (alternative solution approach is not allowed). (20%)

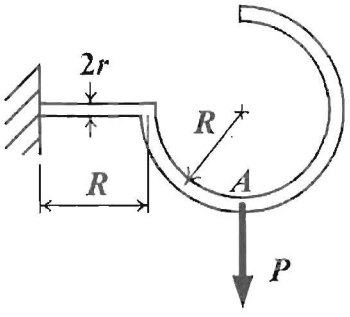

Fig. P5