1. Based on the strength concept, please explain how to design a beam for engineering applications. (20%)

2. Give five methods to increase the buckling strength of a column subjected to compressive loading. (25%)

3. A plate weakened by two holes is subjected to the loads as shown in Fig. 1. If the plate is made of ductile material, please predict the locations where the material is mostly possible to fail by yielding and propose two theories to predict it. (15%)
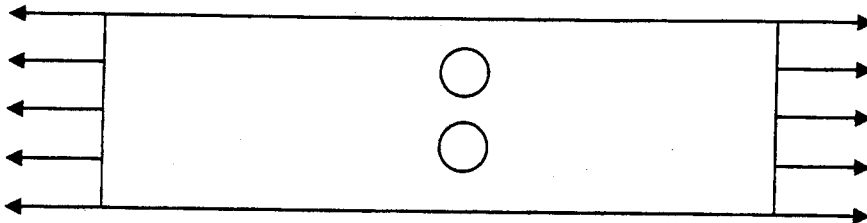

Fig. 1

4. Please write down the total strain energy stored in (1) a rod subjected to axial load; (2) a shaft subjected to twisting moment; and (3) a beam subjected to transverse load. (15%)

5. Translate the following statements into Chinese:

   (1) Mechanics of materials is a branch of mechanics that studies the relationships between the external loads to a deformable body and the intensity of internal forces acting within the body. (5%)

   (2) For design, it is important to determine the orientations of the element that produce the maximum principal normal stress and the maximum in-plane shear stress. (5%)

   (3) Superposition of load and displacement is possible provided the material remains linear elastic and no significant changes in geometry occur. (5%)

   (4) The reactions on a statically indeterminate beam can be determined using both equilibrium and compatibility conditions that specify the displacement at the supports. (5%)

   (5) The change in angle that occurs between two line segments that were original perpendicular to one another is referred to as shear strain. (5%)