國立彰化師範大學 99 學年度碩士班招生考試試題

系所：機電工程學系　　組別：甲組(選考乙)　　科目：材料力學

☆☆請在答案紙上作答☆☆　　

#1. If the working plane is the *x*-*y* plane, find the transformation equations for plane strain. The in-plane strains are expressed by ε_x, ε_y, and γ_{xy}, where ε_x and ε_y are the normal strains in the *x* and *y* directions, respectively; γ_{xy} is the shear strain in the *x*-*y* plane. (25%)

Note: 1. The transformation equations for plane strain can be obtained by transforming the strain components from the *x*-*y* coordinate to the $x'-y'$ coordinate, where the $x'-y'$ coordinate is obtained by rotating the *x*-*y* coordinate counterclockwise (ccw) by an angle θ.

2. Full grade will be given only if all the equations and the plot to indicate the relationship between the *x*-*y* coordinate and the $x'-y'$ coordinate are correct and shown.

#2. Based on problem 1, determine the in-plane principal strains and the in-plane maximum shear strain. What is the relationship between the principal planes and the plane of maximum shear strain? (25%)

Note: High grade will be given only if the required procedures of derivation are shown on your answer sheet.

#3. Considering an isotropic material, if a point of the material is subjected to a state of tri-axial stress, σ_x, σ_y, and σ_z, associated normal strains, ε_x, ε_y, and ε_z being developed in the material, find all the strains by employing linear Hook's law. Assume that *E*, *G* and *v* are, respectively, the Young's modulus, the shear modulus and the Poisson's ratio. (25%)

#4. It is known that there exist two normal stresses for thin-walled pressure cylindrical vessels, called hoop and longitudinal stresses. Considering a closed cylindrical vessel having a wall thickness *t* and inner radius *r*, if a gauge pressure *p* is developed within the vessel by a constant gas with negligible weight, find the two stresses. (25%)

Note: The grading is based on your assumptions and answers. Low grade will be given if the variables shown on your answer sheet are not explicitly defined; high grade will be given only if the required procedures of derivation are shown on your answer sheet.