

系所組別： 奈米科技暨微系統工程研究所甲組

考試科目： 材料力學

考試日期： 0307，節次： 2

※ 考生請注意：本試題 可 不可 使用計算機**Problem 1. (25 Pts)**

A. A 2D stress field $\begin{bmatrix} \sigma_x & \tau_{xy} \\ \tau_{xy} & \sigma_y \end{bmatrix}$ can be expressed as $\begin{bmatrix} -\frac{3}{2}x^2y^2 & xy^3 \\ xy^3 & -\frac{1}{4}y^4 \end{bmatrix}$

Please determine if it is possible within an elastic structural member in equilibrium. (10 Pts)

B. If $\sigma_x = 60$ MPa, $\sigma_y = -20$ MPa, $\tau_{xy} = 35$ MPa, and $\sigma_z = \tau_{yz} = \tau_{zx} = 0$, what are the principal strains? Let $G = 70$ GPa and $\nu = 0.30$. (10 Pts)

C. Please state the von Mises failure criterion. (5 Pts)

Problem 2. (25 Pts)

Please explain the following issues (including definitions, possible mathematical expression, and physical interpretations). (5 points each)

- (a) Hyperelasticity
- (b) Shear Center
- (c) Stress Intensity Factors
- (d) Orthotropic Materials
- (e) Strain-Displacement Relations

(背面仍有題目,請繼續作答)

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※ 考生請注意：本試題 可 不可 使用計算機**Problem 3. (25 Pts)**

- (a) Please sketch the stress-strain curves (both engineering stress/strain and true stress/strain curves) for typical low carbon steels. Please mark all important information on the drawing. (10 Pts)
- (b) Please give us a rough estimation on the magnitude of Young's modulus of the following materials: Quartz, Titanium, Silicon, PMMA, and Copper. (10 Pts)
- (c) Why material's Poisson's ratio cannot exceed 0.5? (5 Pts)

Problem 4. (25 Pts)

- (a) Please state the definition of strain energy (both physical interpretation and mathematical expression) (10 Pts)
- (b) Consider a simply supported beam shown below; please find the central deflection using energy method. (15 Pts)

