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科目：材料力學(A)
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國立臺灣大學 102 學年度碩士班招生考試試題

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Problem 1 (25%)
Use Hooke's law to deduce relations between stress increments for samples of isotropic elastic soil which are being (i) deformed in plane strain and (ii) compressed one-dimensionally.

Problem 2 (25%)
Given an unsymmetrical cross section, we set up a Cartesian coordinate system Oyz calculating $\int_A dA = 10^3$ cm^2, $\int_A y\,dA = -20 \times 10^3$ cm^3, $\int_A z\,dA = 10 \times 10^3$ cm^3, $\int_A y^2\,dA = 38 \times 10^5$ cm^4, $\int_A z^2\,dA = 47 \times 10^5$ cm^4, $\int_A yz\,dA = -10 \times 10^5$ cm^4

If a horizontal cantilever beam is with the above cross section and with length $L = 10$ cm, and is subjected to a vertical end-load $P = 100$ kN at the point $x = L$ acting upward in the positive y direction through the centroid, and a horizontal end-load $H = 50$ kN at the point $x = L$ acting horizontally in the positive z direction through the centroid, calculate the axial stress at a point $(x, y, z) = (5, 15, -10)$.
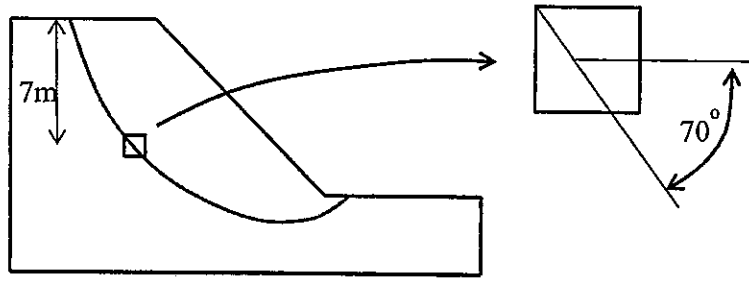
Problem 3 (25%)
The simple beam AB shown in the figure has moments $2M_0$ and M_0 acting at the ends.
(a) Derive the equation of the deflection curve (use the third-order or second-order differential equation of the deflection curve)
(b) Determine the maximum deflection δ_{max}

Problem 4 (25%)
A soil element within a slope is shown in the figure below, where a piezometer around that location has a reading of pore water pressure 50 kPa. A potential slip surface through the soil element has an angle of 70° with respect to a horizontal axis. Determine the factor of safety against shear failure at that location. Please show the stresses on the soil element in an appropriate sketch. The soil has the following information: unit weight = 20 kN/m^3; effective cohesion = 10 kPa; effective internal friction angle = 28°; coefficient of lateral earth pressure at rest = 0.4

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