

國立高雄大學 103 學年度研究所碩士班招生考試試題

系所：

科目：材料力學

土木與環境工程學系(土木工程

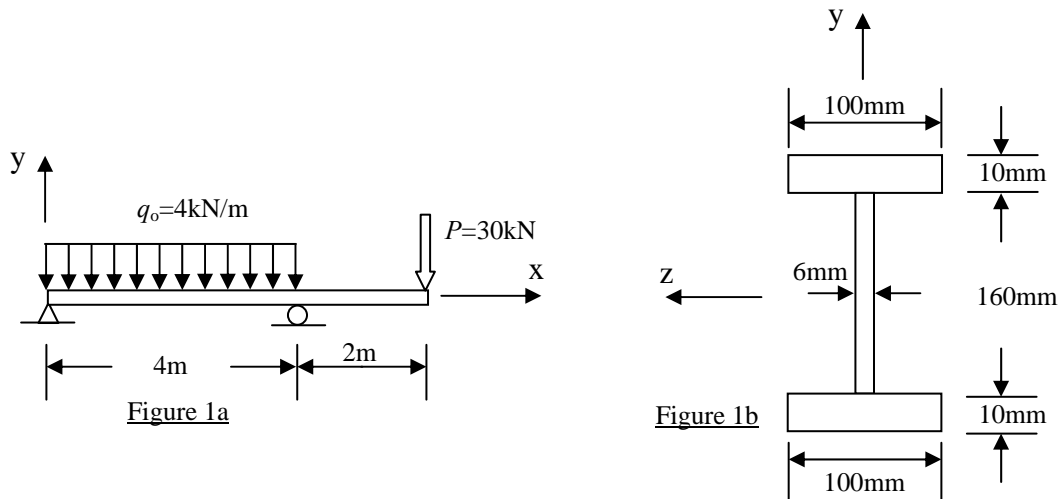
是否使用計算機：是

考試時間：100 分鐘

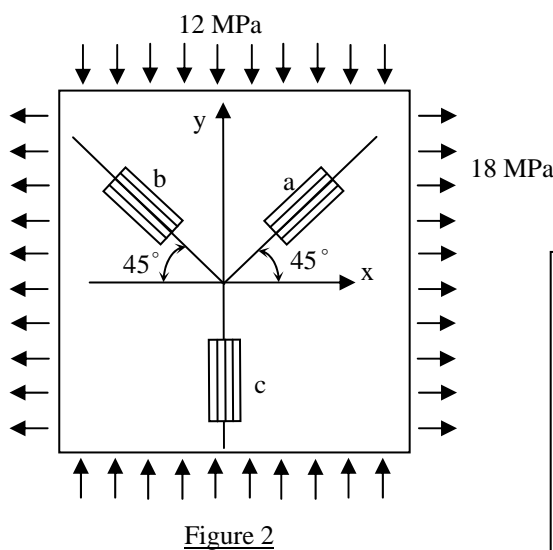
組)

本科原始成績：100 分

1. An I-beam in Figure 1a with the cross section given in Figure 1b is subject to a uniform load $q_0=4\text{kN/m}$ and a concentrated force $P=30\text{kN}$. Please calculate the maximum bending moment M and the maximum shear force V , the maximum tensile bending stress σ_x and the maximum shear stress τ_{xy} . Here, self-weight is negligible. (25%)



2. A plane stress state of a plate is given in Figure 2. What are the corresponding normal strains ϵ_x , ϵ_y , and shear strain γ_{xy} . If three strain gauges a, b, and c are installed to measure the strains ϵ_a , ϵ_b , and ϵ_c , respectively in three directions as shown in Figure 2, what would the measurements in these gauges be? Assume it is linear elastic material with Young's modulus $E=200000\text{ MPa}$ and Poisson's ratio $\nu=0.2$. (25%)



Some expressions might be useful

$$\sigma_{\theta} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta$$

$$\epsilon_{\theta} = \frac{\epsilon_x + \epsilon_y}{2} + \frac{\epsilon_x - \epsilon_y}{2} \cos 2\theta + \frac{\gamma_{xy}}{2} \sin 2\theta$$

$$G = \frac{E}{2(1+\nu)}$$

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3. A cross section of a composite beam made of two materials is subject to a pure bending moment M as shown in Figure 3. Allowable bending stresses are $\sigma_{a1}=200\text{MPa}$ for material 1 and $\sigma_{a2}=72\text{MPa}$ for material 2. Young's moduli are $E_1=200000\text{MPa}$ and $E_2=72000\text{MPa}$ for material 1 and material 2 respectively. What is the allowable bending moment according to the limitation of the allowable stresses? (25%)

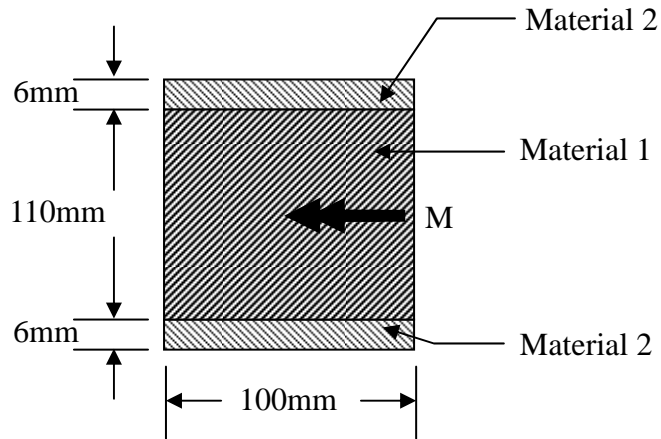


Figure 3

4. A two-segment beam of uniform bending rigidity EI with its left end hinged and right end fixed is connected by a pin at point b as shown in Figure 4. Please calculate the deflection at point b . Also determine the slope at point a . Self-weight and the axial deformations are negligible. (25%)

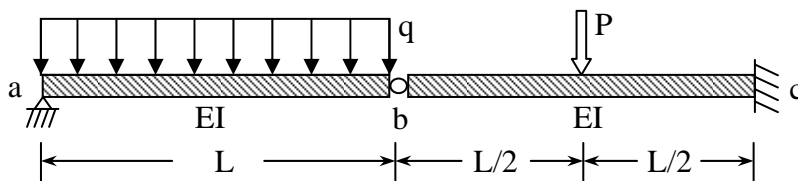


Figure 4