

國立臺北科技大學

九十四學年度土木與防災研究所入學考試

材料力學試題

填 准 考 證 號 碼

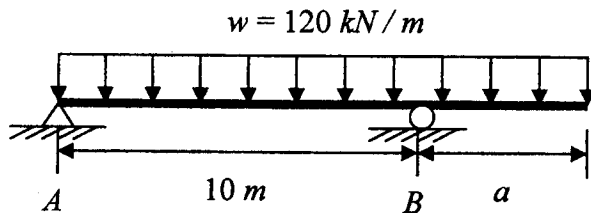
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注意事項：

1. 本試題共 4 題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. A beam with an overhang of constant flexural rigidity EI is loaded as shown in the figure. Determine the length of the overhang such that the elastic curve would be horizontal over the support B. (25)

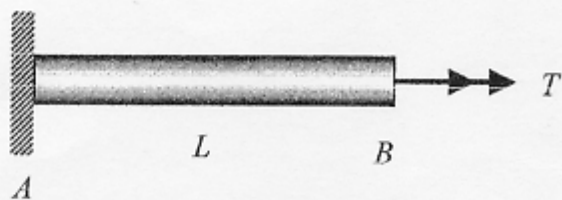


2. A straight shaft of length L has a cross-section which is a solid circle of radius b . It is made from a nonlinearly elastic material with the stress-strain law in shear $\tau = G\gamma^{\frac{1}{2}}$, where G is a constant. The shaft is fixed at end A , and a torque T is applied at end B . The maximum shear stress may be written as

$$\tau_{\max} = \alpha \frac{Tb}{J}$$

where J is the polar moment of inertia of the circular cross-sectional area about its center.

- (a) Determine the numerical value of α (15)
- (b) Determine the angle of rotation of the cross-section at B in terms of T , b , J , G and L . (10)



3. A beam is made up of a material that linearly elastic but has an elastic modulus E_t in tension and an elastic modulus E_c in compression. The cross section is rectangular, h units deep and b units wide. Derive expressions that relate stress to bending moment. The expressions should be in the form of $\sigma = \pm \frac{My}{I}$ for the special case of $E_t = E_c$. (25)
4. A structure, as shown below, is made up of a rigid bar AB and an elastic cantilever column CD (flexural rigidity EI). The rigid bar is rigidly attached at C to the elastic cantilever column. Find the value of P at which the column buckles as the forces P is applied at A and B . (25)

