# 國立中央大學八十四學年度碩士班研究生入學試題卷

所別：機械工程研究所　甲組　科目：材料力學　共 1 頁 第 1 頁

參考用

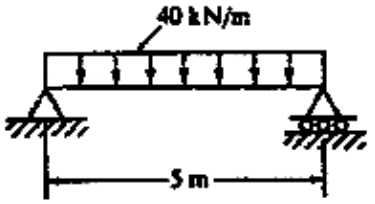
1. Define or explain the following technical terms.
   (1) Homogeneous and isotropic materials *(2%)*
   (2) Nominal and true strains *(2%)*
   (3) Elasticity and plasticity *(2%)*
   (4) Poisson's ratio *(2%)*
   (5) Factor of safety *(2%)*
   (6) Modulus of toughness *(2%)*
   (7) Statically indeterminate problems *(2%)*
   (8) Torsional stiffness or torsional rigidity *(2%)*

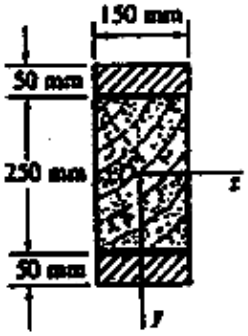
2. A tapered bar AB of circular cross section is twisted by torques T applied at the ends. The diameter of the bar *varies uniformly* from $d_a$ at the left end to $d_b$ at the right end. Derive a formula for the angle of twist $\phi$ of the bar. Assuming that $d_b > d_a$. *(9%)*

3. The composite beam shown in the following figure is simply supported, and it carries a total uniform load of 40 kN/m on a span length of 5 m. The beam is built of a wood member having cross-sectional dimensions 150 mm x 250 mm and two steel plates of dimensions 50 mm x 150 mm.

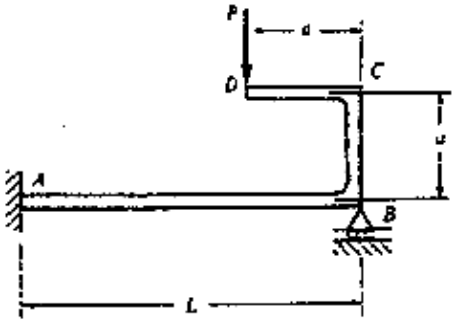
   (1) Determine the maximum stresses $\sigma_s$ and $\sigma_w$ in the steel and wood, respectively, if the moduli of elasticity are $E_s$ = 210 GPa (steel) and $E_w$ = 11 GPa (wood). *(13%)*

   (2) Find the maximum permissible bending moment $M_{max}$ about the z axis if the allowable stress in the wood is 8 MPa and in steel is 130 MPa. *(12%)*




4. The beam AB with an attached bracket BCD is supported and loaded as shown in the following figure. The flexural rigidity EI is the same for all parts of the structure. Determine the horizontal deflection $\delta_h$ and vertical deflection $\delta_v$ at point D. *(25%)*




5. A 10,000-lb elevator is supported by a standard steel cable of 2.5-in.$^2$ cross section and an effective modulus of elasticity of 15 x $10^6$ psi. As the elevator is descending at a constant velocity of 3 ft per second, an accident causes the top of the cable, 60 ft above the elevator, to stop suddenly. Estimate the maximum elongation and maximum tensile stress developed in the cable at this impact. *(25%)*