臺灣綜合大學系統 109 學年度學士班轉學生聯合招生考試試題

科目名稱	材料力學	類組代碼	D37
		科目碼	D3793

※本項考試依簡章規定所有考科均「不可」使用計算機。　　本科試題共計 2 頁

1. A stepped bar ACB with **square** cross sections is held between rigid supports and loaded by an axial force P at midlength (see Figure 1). The width for the two parts of the bar are $b_1 = d_1 = 20$ mm mm and $b_2 = d_2 = 40$ mm, and the material is elastoplastic with yield stress $\sigma_y = 250$ MPa. Determine the **plastic load** P_p. (20%)

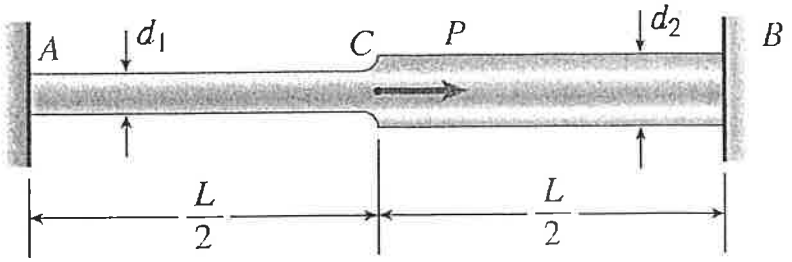

Figure 1

2. A simple beam AB shown in Figure 2 is subjected to a distributed load of intensity $q(x) = q_o \sin\frac{\pi x}{L}$, where q_o is the maximum intensity of the load. Determine **the maximum absolute value of the bending moment** M_{max}, and **the maximum deflection** δ_{max} **in the beam**. (20%)

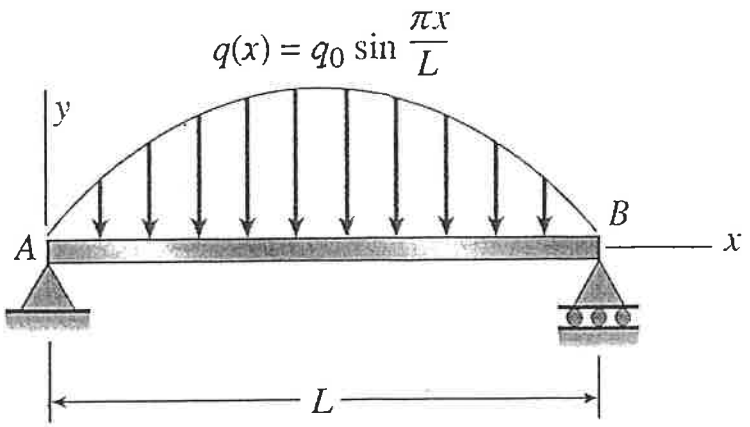

Figure 2

3. In Figure 3, a cantilever beam of length L and loaded by uniform load of intensity q has a fixed support at A and spring support at B with rotational stiffness k_R. A rotation at B, θ_B, results in a reaction moment $M_B = k_R \times \theta_B$. Use the second-order differential equation of the deflection curve to solve for **displacements** δ_B **at end** B. (20%)

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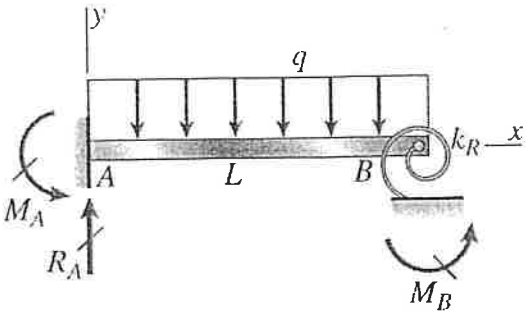


Figure 3

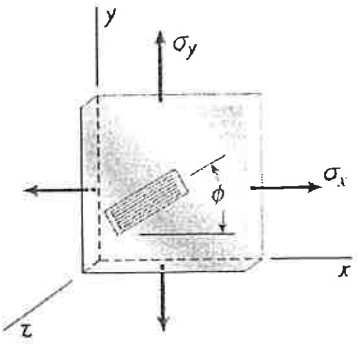
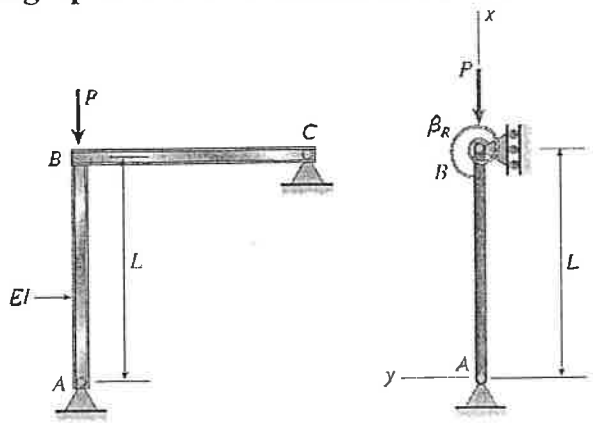


Figure 4

4. A steel plate with a modulus of elasticity $E = 200$ GPa and Poisson's ratio $\upsilon = 0.3$ is loaded in biaxial stress by normal stresses σ_x and σ_y (see Figure 4). A strain gage is bonded to the plate at an angle $\phi = 30°$. If the stress σ_x is 100 MPa and the strain measured by the gage is $\varepsilon = 340\times10^{-6}$, what is the **maximum in-plane shear stress** $(\tau_{max})_{xy}$ and **maximum in-plane shear strain** $(\gamma_{max})_{xy}$? (20%)

5. The frame *ABC* consists of two members *AB* and *BC* that are rigidly connected at joint *B*, as shown in part (a) of the Figure 5. The frame has pin supports at *A* and *C*. A concentrated load *P* acts at joint *B*, thereby placing member *AB* in direct compression. To assist in determining the buckling load for member *AB*, represent it as a pinned-end column, as shown in part (b) of the Figure 5. At the top of the column, a rotational spring of stiffness β_R represents the restraining action of the horizontal beam *BC* on the column (note that the horizontal beam provides resistance to rotation of joint *B* when the column buckles). Also, consider only bending effects in the analysis (i.e., disregard the effects of axial deformations). By solving the differential equation of the deflection curve, derive the **buckling equation** for this column *AB*. (20%)



(a)　　(b)

Figure 5