

國立成功大學

111學年度碩士班招生考試試題

編 號： 104

系 所： 土木工程學系

科 目： 材料力學

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節 次： 第 1 節

備 註： 可使用計算機

※ 考生請注意：本試題可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Beam AB of a length  $L$  has a fixed-support at A and a roller support at B (see Figure 1). Support B is also restrained by a linear rotational spring with stiffness  $k_R = 2EI/L$ , which provides a resisting moment  $M_B$  due to rotation at B. If the beam is subjected to a support settlement  $\Delta$  at support B, use the 4th-order differential equation of the deflection curve  $EIv'''' = -q(x)$  and the successive integration method to compute the equation of the deflection curve  $v(x)$ . (b) Compute the reaction moments  $M_A$  and  $M_B$  at supports A and B. (此題必須使用指定方法，否則不計分)(25%)

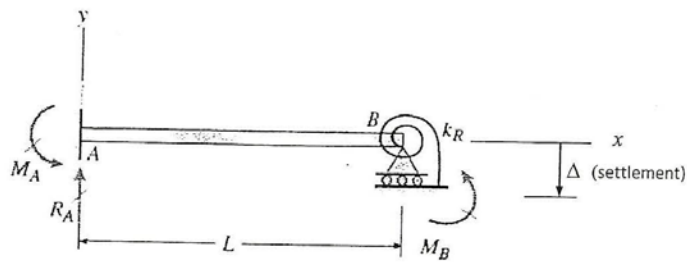


Figure 1

2. A cantilever beam with a rectangular cross-section is loaded by a horizontal force  $Q$  and a vertical force  $P$  that act at the mid-height of the beam (see Figure 2). Two strain gages are placed at point C, which is also located at the mid-height of the beam. Gage A measures the strain in the horizontal direction, and gage B measured the strain at an angle  $60^\circ$  to the horizontal. Determine the forces  $Q$  and  $P$ , if the measured strains are  $\epsilon_A = 145 \times 10^{-6}$  and  $\epsilon_B = -165 \times 10^{-6}$ . Assume the material has  $E = 200 \text{ GPa}$ , and  $\nu = 1/3$ , and the cross-section of the beam is 20 mm wide and 175 mm deep. (25%)

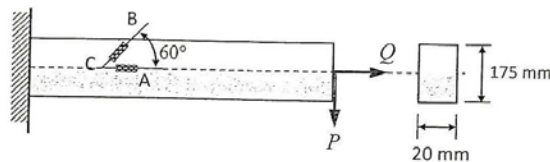


Figure 2

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3. A simply supported composite beam of 3 m long carries a concentrated load  $P$  (see Figure 3), which acts at the center of the span. The beam is constructed of a wood member, 100 mm wide by 150 mm deep, and is reinforced on its lower side by a steel plate of 8 mm thick and 100 mm wide. (a) Locate the neutral axis  $h_1$  measured from the top surface of the beam. (b) Compute the maximum allowable load  $P_{max}$ , if the allowable stresses for the wood and steel are  $\sigma_{aw} = 5.1 \text{ MPa}$  and  $\sigma_{as} = 100 \text{ MPa}$ , respectively. (25%)

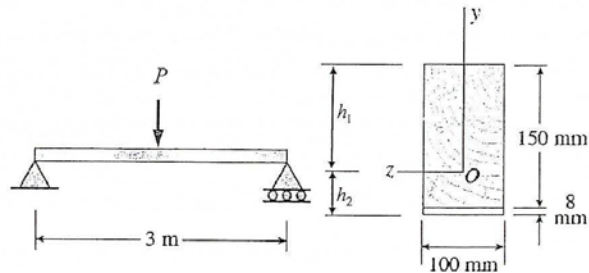


Figure 3

4. As shown in Figure 4(a), an ideal column with both ends fixed against rotation is subjected to an axial load  $P$ . (a) Establish the 2<sup>nd</sup>-order differential equation of the deflection curve for this column. (b) Find the solutions for the critical load  $P_{cr}$  and the buckled shape (see Figure 4(b)) of the column by solving the established 2<sup>nd</sup>-order differential equation of the deflection curve. Assume  $EI$  of the column cross-section is a constant and the column length is  $L$ . (25%)

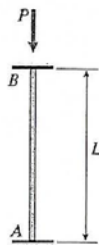


Figure 4(a)

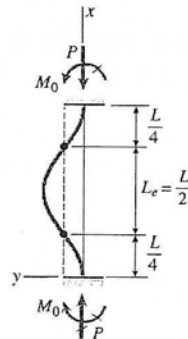


Figure 4(b)