Prince of Songkla University

Faculty of Engineering

Midterm Examination: Semester II — Academic Year 2006

Saturday, December 16, 2006 — Time 9:00-12:00

220-506 Stability of Structures — Room A201

Instructions.

1. There are 3 questions which full marks are shown next to the question numbers.
2. Attempt all questions.
3. Books and notes are allowed.
4. Pencils are recommended to be used in answering the questions.

Instructor : Fukit Nilrat

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1. (20 marks) Find the critical load P_{cr} of the rigid bar-spring system is shown in Figure 1.
2. (30 marks) Find the characteristic equation that may be used to solve for the buckling load of the stepped column shown in Figure 2 by using the second–order differential equation.
3. (30 marks) For the beam-column shown in Figure 3.1, the deflection equations are given as

$$y(x) = \frac{Q}{EI\lambda^3}\frac{\sin\lambda(l-a)}{\sin\lambda l}\sin\lambda x - \frac{Q(l-a)}{lEI\lambda^2}x \qquad \text{for } 0 \le x \le a$$

$$y(x) = -\frac{Q\sin\lambda a}{EI\lambda^3\tan\lambda l}\sin\lambda x + \frac{Q\sin\lambda a}{EI\lambda^3}\cos\lambda x - \frac{Qa(l-x)}{lEI\lambda^2} \qquad \text{for } a \le x \le l$$

For the beam-column shown in Figure 3.2

(a) Determine the maximum deflection y_O and the maximum bending moment M_O for the beam-column shown in Figure 3.2 when the axial load P = 0.

(b) The maximum deflection y_{max} and the maximum bending moment M_{max} for the beam-column shown in Figure 3.2 when the axial load P is present can be expressed as

$y_{max} = y_O A_{Fy}$

$M_{max} = M_O A_{FM}$

By using the principle of superposition, find the deflection amplification factor A_{Fy} and the moment amplification factor A_{FM} in terms of u where $u = \lambda l/2$.

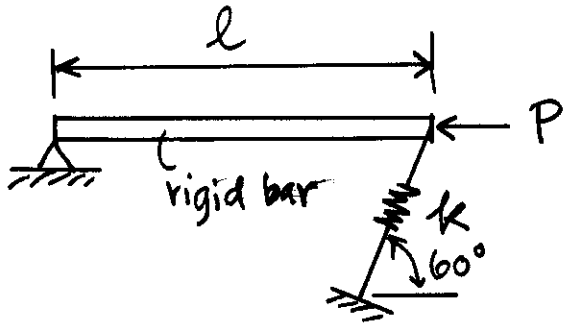

Figure 1

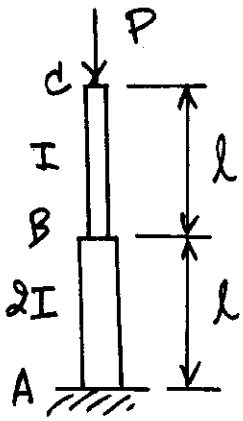

Figure 2

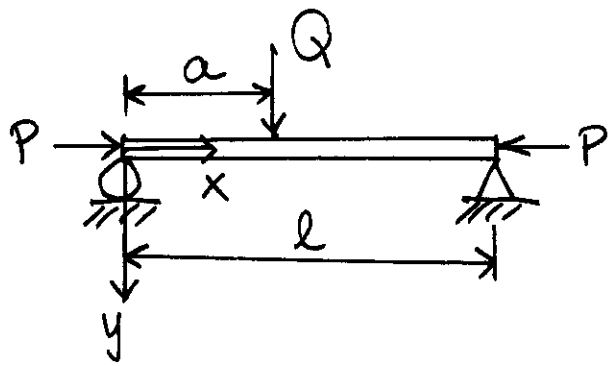

Figure 3.1

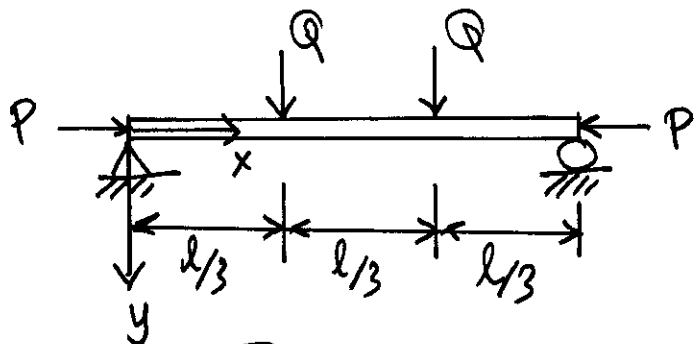

Figure 3.2