Prince of Songkla University

Faculty of Engineering

Midterm Examination: Semester II | Academic Year 2008

Monday, December 22, 2008 | Time 13:30-16:30

220-506 Stability of Structures | Room A201

Instructions.

1. There are 3 questions with equal marks.
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. (30 marks) Find the critical loads P_{cr} of the rigid bar-spring systems shown in Figure 1.1 and Figure 1.2.
2. (30 marks) Find the characteristic equation that may be used to solve for the buckling load of the continuous beam 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

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

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

For the beam-column shown in Figure 3.2

(a) Determine the maximum deflection y_0 for the beam-column shown **in Figure 3.2 when the axial load P = 0**.

(b) The maximum deflection y_{max} for the beam-column shown in Figure 3.2 when the axial load P is present can be expressed as $y_{max} = y_0 A_F$. By using the principle of superposition, find the deflection amplification factor A_F in terms of u where $u = \lambda l/2$.

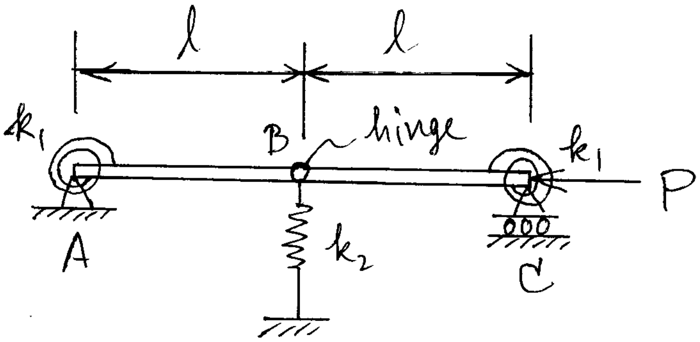

Figure 1.1

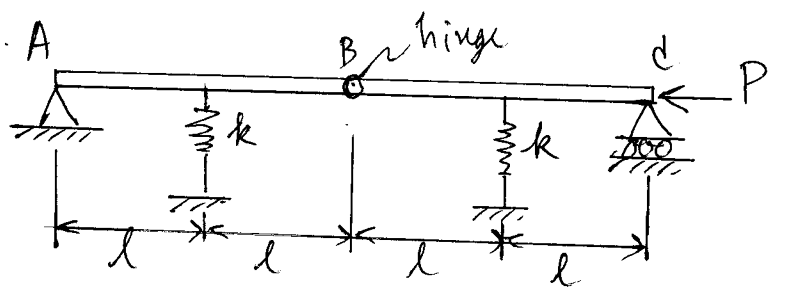

Figure 1.2

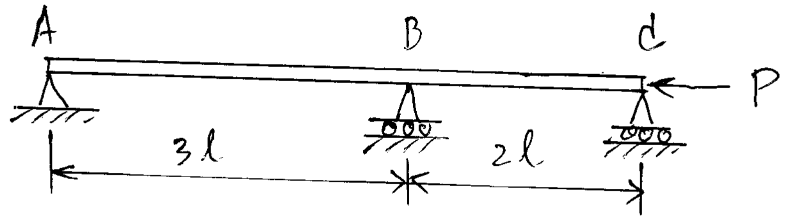

Figure 2

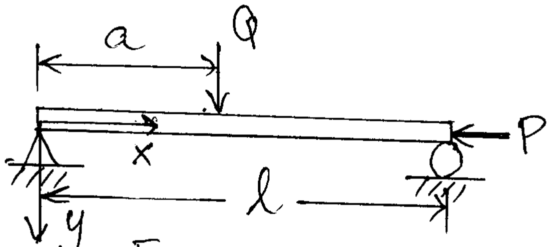

Figure 3.1

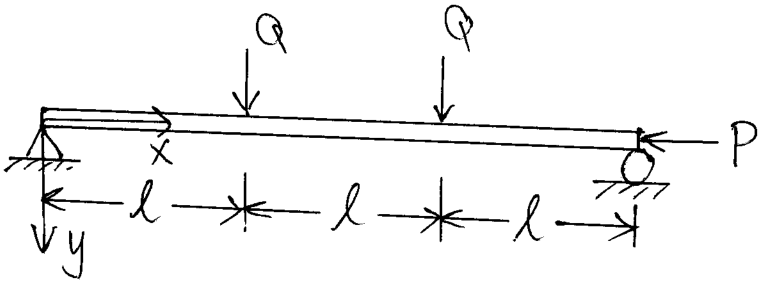

Figure 3.2