

Prince of Songkla University

Faculty of Engineering

Midterm Examination: Semester I

Academic Year 2007

Sunday, July 27, 2007

Time 9:00-12:00

220-503 Dynamics of Structures

Room: A400

Name Student No.

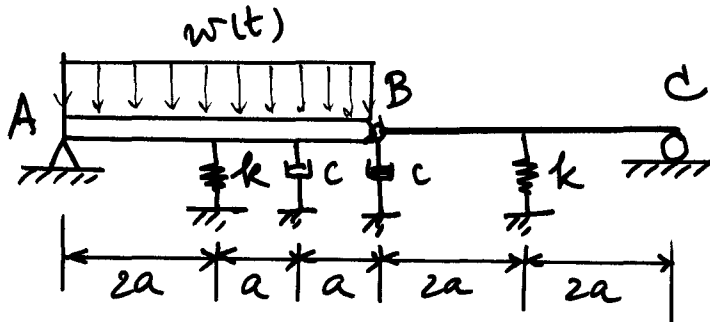
Instructions

1. There are 4 questions which marks are as shown in the table below.
2. Attempt all questions using this question-answer book.
3. Books and notes are allowed.
4. Pencils are recommended to be used in answering the questions.

| Question | Full Marks | Graded Marks |
|----------|------------|--------------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| Total | | |

Instructor : Fukit Nilrat

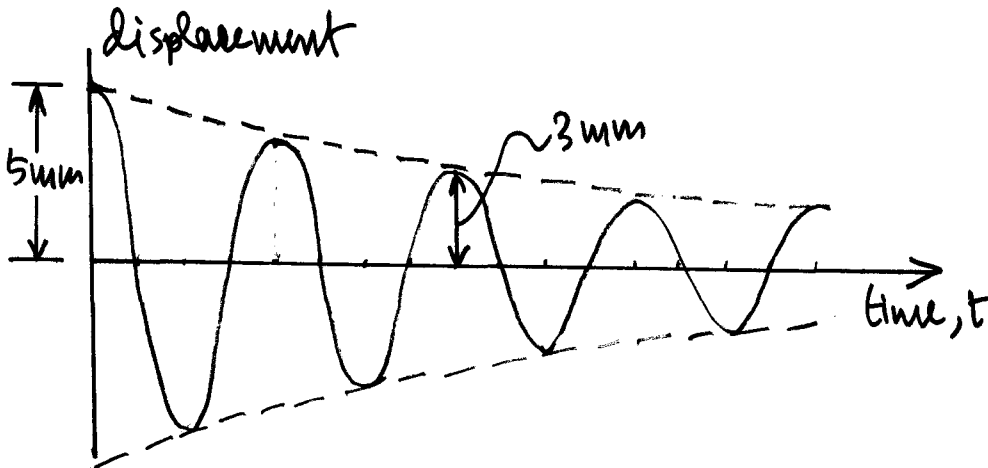
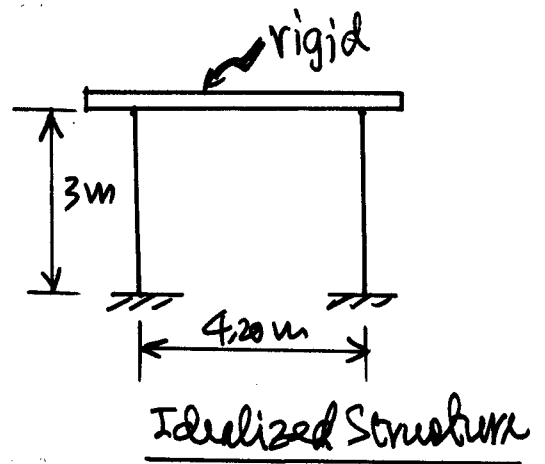
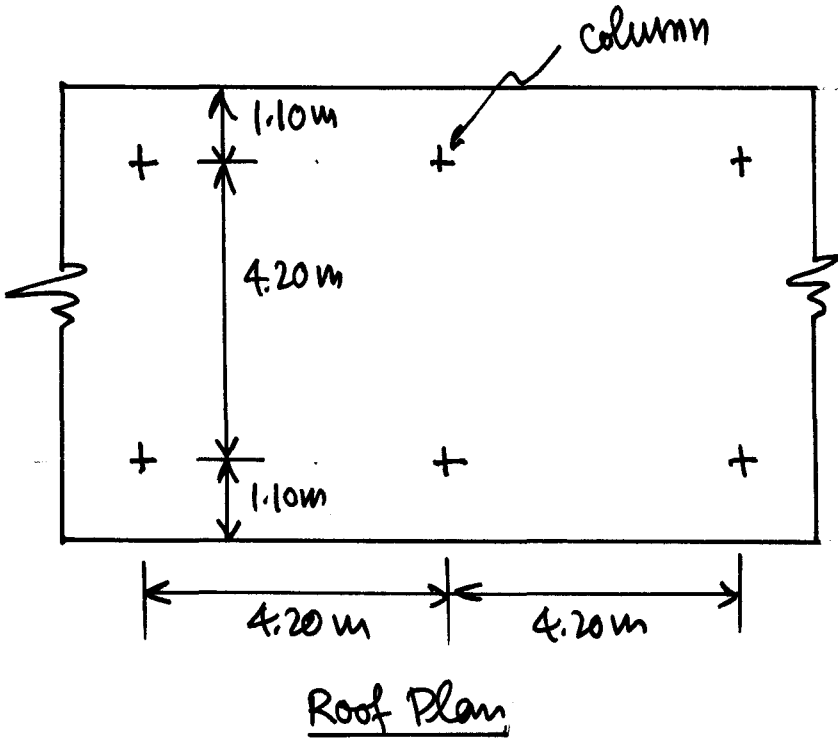
1. (20 marks) A uniform rigid beam AB with mass per unit length m is connected to a massless rigid beam BC by a hinge at B. The system is subjected to a uniformly distributed load $w(t)$ and a point load $P(t)$, and it is constrained by linear springs and dampers as shown. Formulate the equation of motion of the system.



2. (30 marks) A roof plan of a one-story reinforced concrete building is as shown. The roof is a flat plate or flat slab with uniform thickness of 0.15 m and the columns are square columns which cross sectional dimensions of 0.30x0.30 m. The structure is idealized as a rigid girder supported by massless columns as shown. The reinforcing steels and the geometric stiffness of the system are neglected. The modulus of elasticity of concrete is given as 20 GPa.

(a) Determine the natural period of the system.

(b) When the roof is displaced laterally for 5 mm and then it is released, it is found that after 2 periods the lateral displacement is 3 mm as shown in the time-displacement graph. Determine the damping ratio of the system.



3. (40 marks) Express the periodic loading shown as a Fourier series by determining the coefficients of the series. An undamped single degree of freedom (SDOF) is subjected to this periodic loading and the ratio of the period of the loading to the period of the system is $5/4$, determine the steady-state displacement response of the system.

