

Prince of Songkla University

Faculty of Engineering

Midterm Examination: Semester I

Academic Year 2006

Sunday, July 30, 2006

Time 9:00-12:00

220-503 Dynamics of Structures

Room: Robot Conference

Name..... Student No.

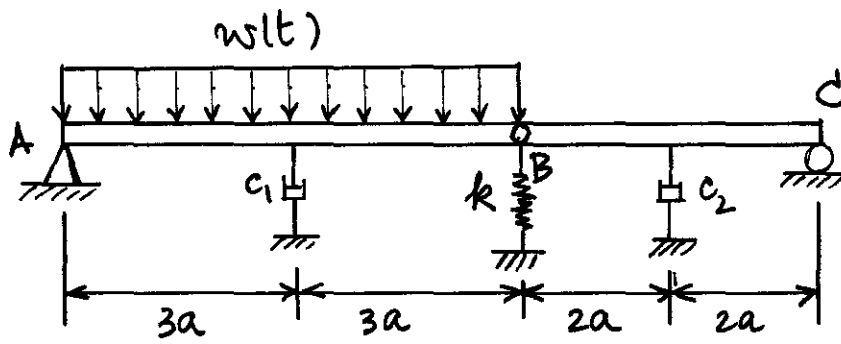
Instructions.

1. There are 4 questions which marks 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.
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Question	Full Marks	Marks Scored
1	20	
2	20	
3	30	
4	30	
Total	100	

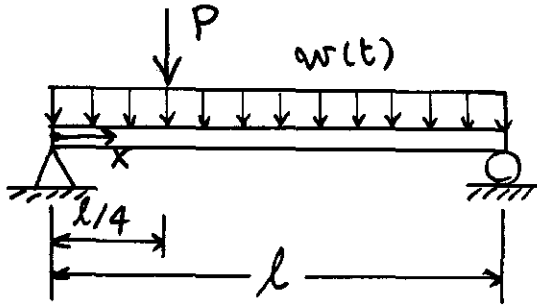
Instructor : Fukit Nilrat

1. (20 marks) Uniform rigid beams (mass per length = m) AB and BC are connected by a hinge at B. The system is subjected to a uniformly distributed load per unit length $w(t)$ and it is constrained by a linear spring and dampers as shown. Formulate the equation of motion of the system.



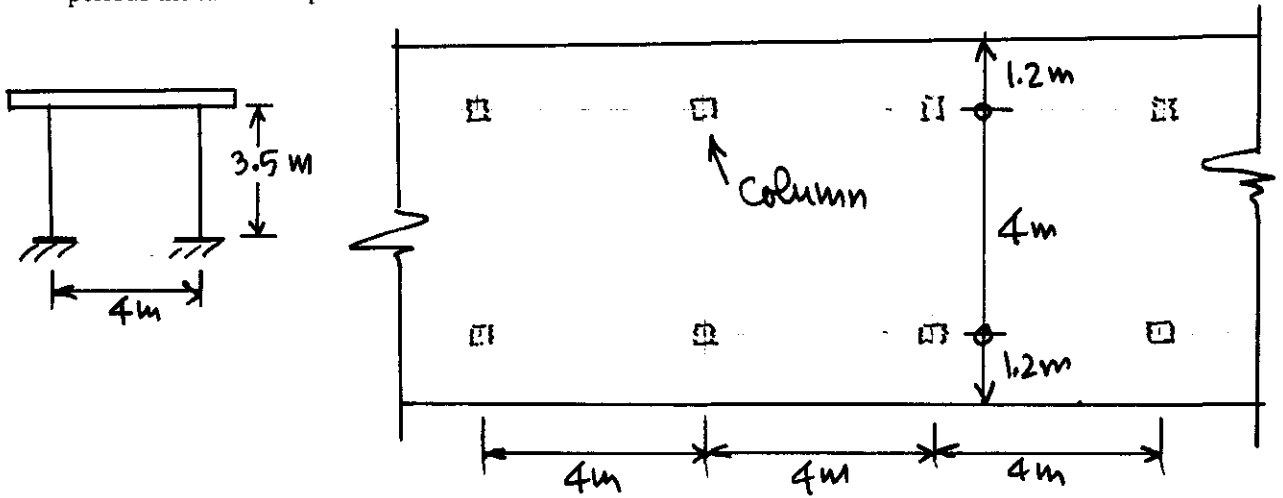
2. (20 marks) A simple beam shown is treated as a single degree of freedom (SDOF) system by defining its displaced shape as $\varnothing(x) = \sin(\pi x/l)$. The mass per length of the uniform beam is m and the flexural stiffness is EI . The beam is subjected to a uniformly distributed load per unit length $w(t)$ and a point load P at the location as shown.

- (a) Evaluate the generalized mass, generalized stiffness and generalized loading of the system.
- (b) Assuming damping ratio to be 0.03, formulate the equation of motion of the system by defining generalized displacement coordinate $Z(t)$.



3. (30 marks) A one-story building is idealized as a rigid girder supported by massless columns as shown. The plan of the reinforced concrete flat plate roof is as shown. The thickness of the flat plate is 0.15 m and the cross sectional size of the rectangular reinforced concrete columns is 0.25x 0.25 m.

- (a) Determine the natural period of the system by assuming the modulus of elasticity of concrete to be 20 GPa and neglecting the reinforcement.
- (b) When the roof or the rigid girder is displaced laterally for 5.0 mm and released, it is found that after 2 periods the lateral displacement is 3.2 mm. Determine the damping ratio of the system.



4. (30 marks) Express the periodic loading shown as a Fourier series by determining the coefficients of the series. An undamped single degree of freedom (SDOF) system is subjected to the loading, and the ratio of the period of the loading to the period of the system is $4/3$, determine the steady-state displacement response for the system.

