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King Mongkut's University of Technology Thonburi

Midterm Examination
Semester 1 Academic Year 2018

CVE 338: Structural Analysis II

Date: 2nd October 2018 Time 9:00 –12:00

Instructions:

1. The exam has **4** questions in **11** pages. Total points are **40** points with each question not of equal points.
2. Read the questions carefully and strictly follow instruction.
3. Textbooks and written materials **are not allowed** in the examination room.
4. A calculator is allowed.
5. Write your name on every page.
6. Perform your work in the examination paper.

Examiner: Assistant Professor Dr. Aphinat Ashakul
Tel. 02-470-9148

This examination paper has been approved by the Department of Civil Engineering

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Associate Professor Dr. Sutat Leelataviwat
Head of the Civil Engineering Department

Student Name & I.D._____

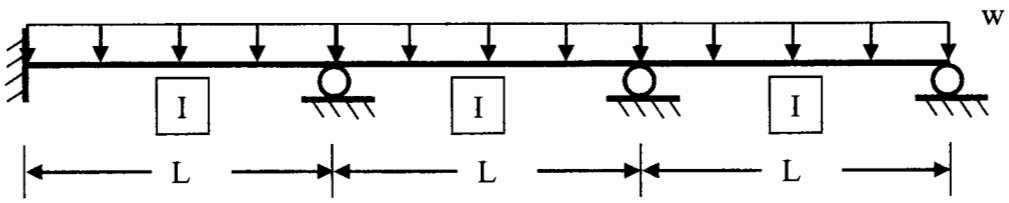
Student Name & I.D._____

1. (**6 Points**) Write problem statements for the structures shown if the method of Slope Deflection is to be employed. Statements must contain the following:

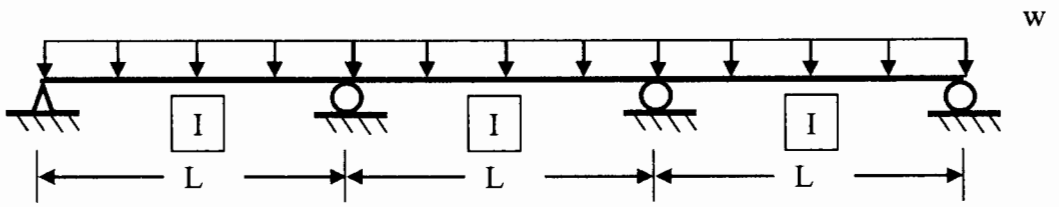
Degrees of Freedom of the structure need to be solved in general

Degrees of Freedom of the structure need to be solved when taking advantage of symmetry and simple end-support conditions

No of equilibrium equations needed



Statement



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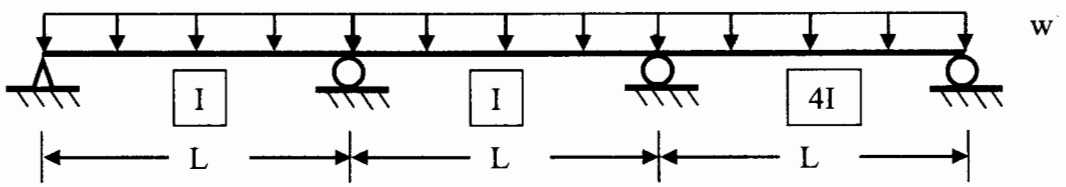

Statement

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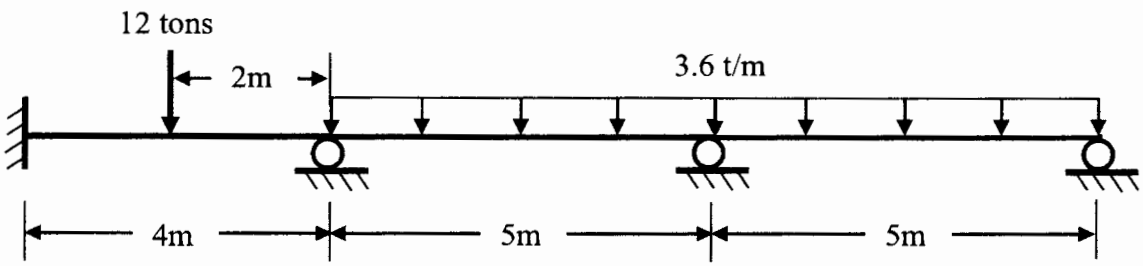
2. (**15 points**) Solve the continuous beam shown by using the Slope Deflection Equation. Solution must include:

a) Free body diagram with complete end moments and shear, and

b) Values of maximum positive and negative moment for each member

EI is constant.

- A problem statement must be written (your unknowns and no. of equilibrium equations must be stated prior to calculation)
- It is recommended that the modified equation for a simple end support be used to help reduce the unknowns.
- Wrong stiffness and FEM will result in zero points – meaning you are judged not to have the ability to solve the structure at all.



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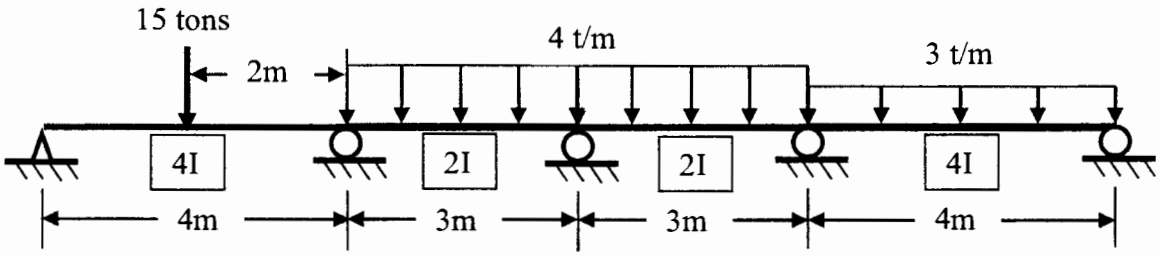
3. (**10 points**) Solve the following beam by using the Moment Distribution Method. Free Body Diagram presenting end moments and shear must be presented. EI is constant.

- It is recommended that the modified stiffness for a simple end support be used to help reduce the procedure.
- Wrong stiffness and FEM will result in zero points – meaning you are judged not to have the ability to solve the structure at all.
- It is also recommended that you perform the moment distribution on this page underneath the problem – calculations of stiffness and FEM can be done in the next page.



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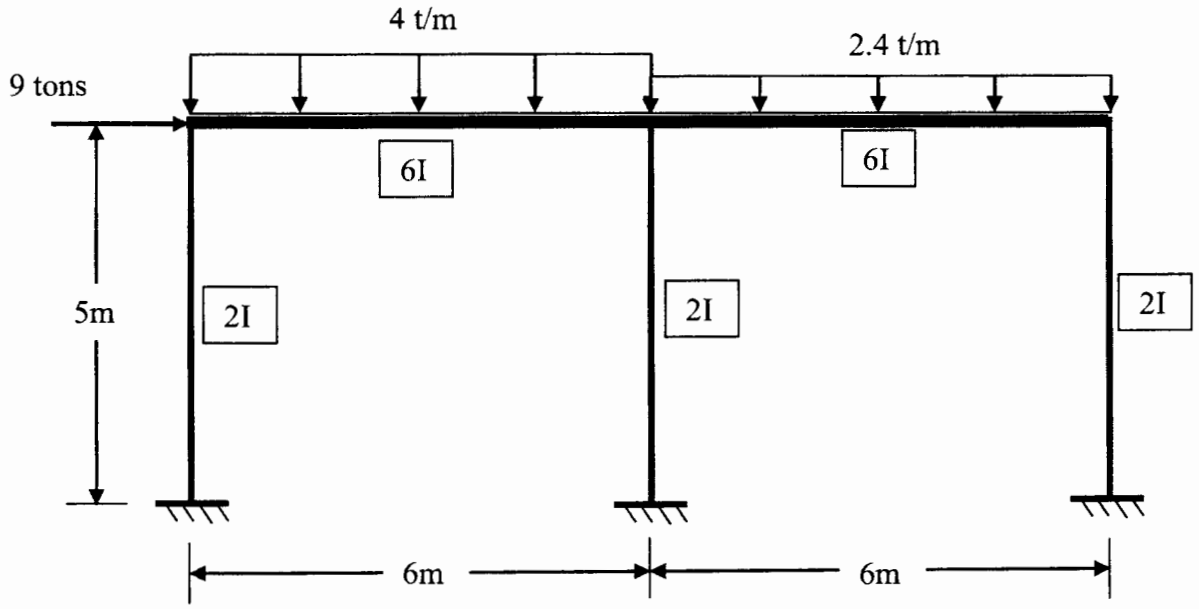
4. **(9 points)** Establish the equilibrium equations necessary to solve the frame shown.
   - A problem statement must be provided.



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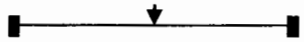
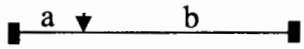
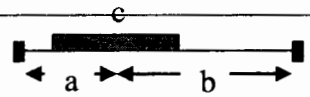
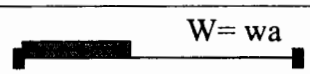
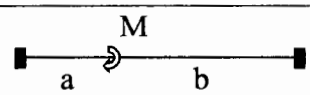
Selected Fixed End Moments

Load Characteristics	FEM_{AB}	FEM_{BA}
	$-\frac{PL}{8}$	$\frac{PL}{8}$
	$-\frac{Pab^2}{L^2}$	$\frac{Pa^2b}{L^2}$
 W= wL	$-\frac{wL^2}{12} = -\frac{WL}{12}$	$\frac{wL^2}{12} = \frac{WL}{12}$
	$-\frac{Wa}{12L^2}[12a^2b + c^2(L - 3b)]$	$\frac{Wa}{12L^2}[12ab^2 + c^2(L - 3a)]$
	$-\frac{Wa}{12L^2}(6L^2 - 8aL + 3a^2)$	$\frac{Wa^2}{12L^2}(4L - 3a)$
If a = L/2 in the case above	$-\frac{11wL^2}{192}$	$\frac{5wL^2}{192}$
	$\frac{Mb}{L^2}(3a - L)$	$\frac{Ma}{L^2}(3b - L)$
	$\frac{6EI\Delta}{L^2}$	$\frac{6EI\Delta}{L^2}$

Slope-Deflection Equations

$$M_{ij} = 2E(K)_{relative}(2\theta_i + \theta_j - 3\psi_{ij}) + FEM_{ij}$$

Modification for Simple End Support (When i is the simple end)

$$M_{ji} = 3E(K)_{relative}(\theta_j - \psi_{ij}) + FEM_{ji} - FEM_{ij}/2$$

Useful Moment Distribution modified stiffness

Simple End Support:	K^m	=	0.75k
Symmetry with odd number of spans:	K^m	=	0.5k
Anti-symmetry with odd number of spans:	K^m	=	1.5k
Symmetry with even number of spans:	K^m	=	1.0k
Anti-symmetry with even number of spans:	K^m	=	0.75k