

DEPARTMENT OF CIVIL ENGINEERING  
**CE-317 STRUCTURAL MECHANICS II**  
 Quiz-1      24/8/13

**PAPER CODE: A**

**Note:** Write your name and roll no. on the answerscript and on the summary answer sheet.  
 Closed book, closed notes test. No formula sheet allowed. No mobile phones allowed in the exam hall.

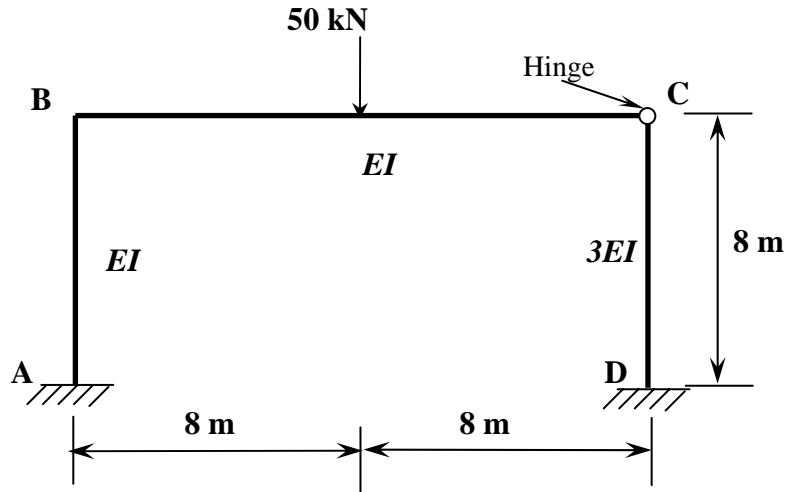
**Problem 1**

**You must use only Moment Distribution Method in this question.**  
**You must use modified stiffnesses wherever possible in this question..**

For the frame in **Fig. 1**, find

- (i) **horizontal force required at C to prevent sway**
- (ii) **reaction moments at A and D for the loading shown.**

**Fig. 1**



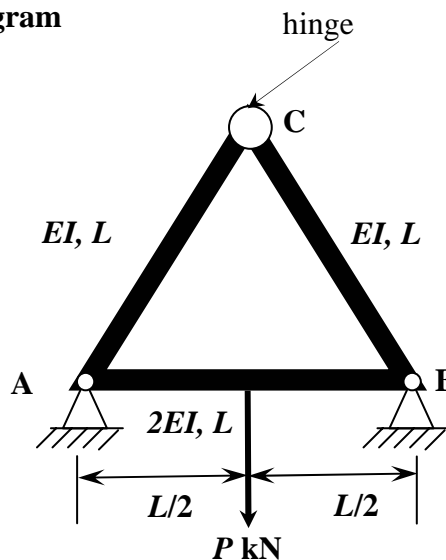
**Problem 2**

**You must use only Slope Deflection Method in this question.**

For the frame in **Fig. 2**,

- (i) **find  $\theta_A$**
- (ii) **draw the Bending Moment Diagram**

**Fig. 2**



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**PAPER CODE: B**

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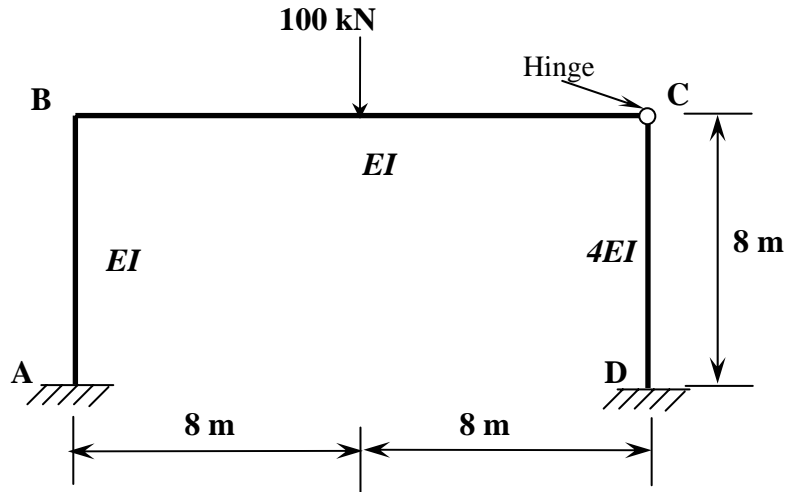
**Problem 1**

**You must use only Moment Distribution Method in this question.**  
**You must use modified stiffnesses wherever possible in this question..**

For the frame in Fig. 1, find

- (i) horizontal force required at C to prevent sway
- (ii) reaction moments at A and D for the loading shown.

Fig. 1



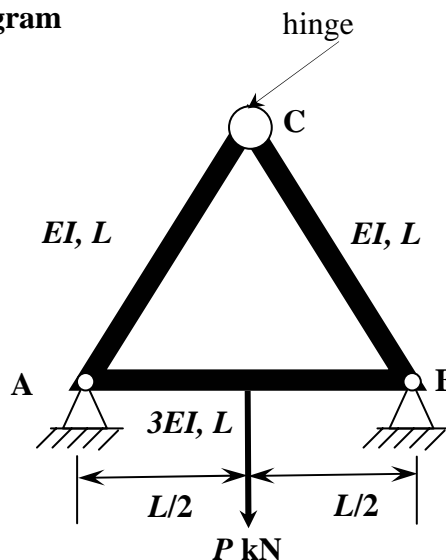
**Problem 2**

**You must use only Slope Deflection Method in this question.**

For the frame in Fig. 2,

- (i) find  $\theta_A$
- (ii) draw the Bending Moment Diagram

Fig. 2



DEPARTMENT OF CIVIL ENGINEERING  
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**PAPER CODE: C**

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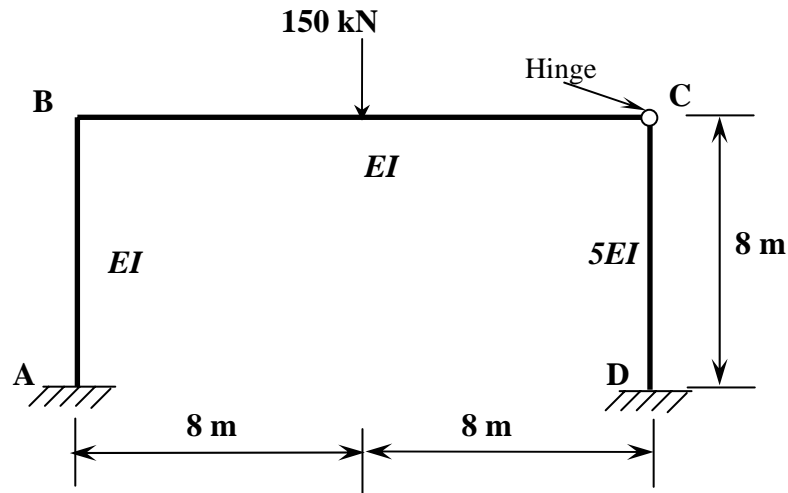
**Problem 1**

You must use only Moment Distribution Method in this question.  
You must use modified stiffnesses wherever possible in this question.

For the frame in Fig. 1, find

- (i) horizontal force required at C to prevent sway
- (ii) reaction moments at A and D for the loading shown.

Fig. 1



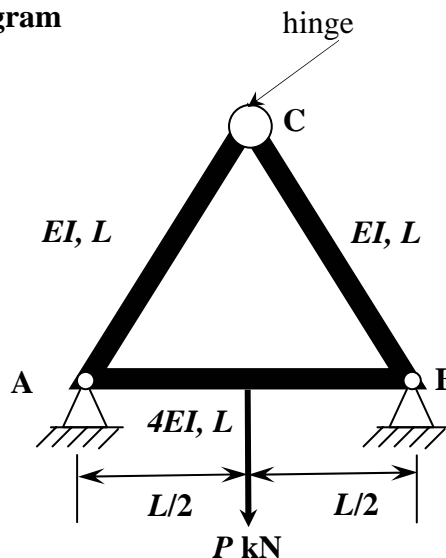
**Problem 2**

You must use only Slope Deflection Method in this question.

For the frame in Fig. 2,

- (i) find  $\theta_A$
- (ii) draw the Bending Moment Diagram

Fig. 2



DEPARTMENT OF CIVIL ENGINEERING  
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**PAPER CODE: D**

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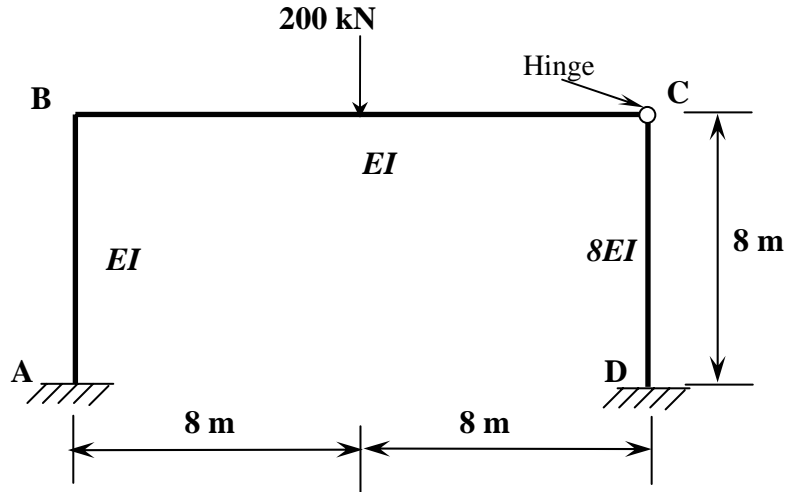
**Problem 1**

**You must use only Moment Distribution Method in this question.**  
**You must use modified stiffnesses wherever possible in this question.**

For the frame in Fig. 1, find

- (i) horizontal force required at C to prevent sway
- (ii) reaction moments at A and D for the loading shown.

Fig. 1



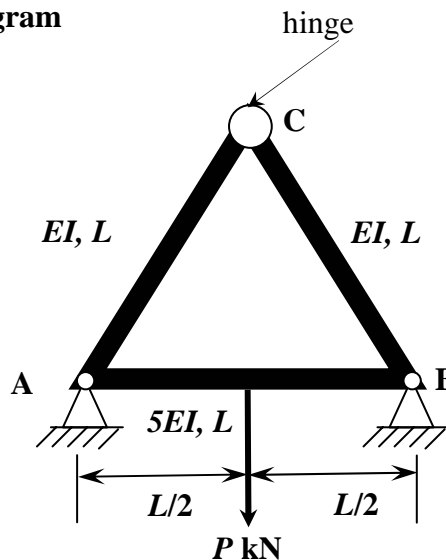
**Problem 2**

**You must use only Slope Deflection Method in this question.**

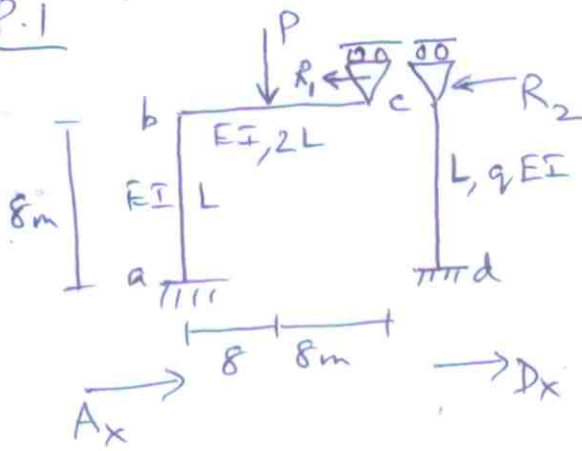
For the frame in Fig. 2,

- (i) find  $\theta_A$
- (ii) draw the Bending Moment Diagram

Fig. 2



P.1



Paper code A:  $P=50, q=3$   
 B:  $P=100, q=4$   
 C:  $P=150, q=5$   
 D:  $P=200, q=8$

Paper code B:

	ab	ba	bc	cb	cd	dc
R	1	1	1/2	1/2	4	4
mod stiff	1	1	3/8	-	-	3
df	-	8/11	3/11	-	-	-
fem	0	0	-300	0	0	0
dist, co	109.09	218.18	81.82	0	0	0
BM'	109.09	218.18	-218.18	0	0	0
fem	-100	-100	0	0	0	-200
dist, co	36.36	72.73	27.27	0	0	0
BM''	-63.64	-27.27	27.27	0	0	-200
BM	37.50	187.50	-187.50	0	0	-225

No sway:

$$A_x = \frac{109.09 + 218.18}{8}$$

$$= 40.91 (\rightarrow)$$

$$\therefore R_1 = 40.91 (\leftarrow)$$

$$D_x = R_2 = 0$$

Sway:

$$fem = 6EI\Delta/L^2$$

$$fem' = 3(qEI)\frac{\Delta}{L^2} = 3(4EI)\frac{\Delta}{L^2}$$

$$A_x' = \frac{-63.64 - 27.27}{8}$$

$$= -11.36 (\rightarrow)$$

$$\therefore R_1' = -11.36 (\leftarrow)$$

$$D_x' = -\frac{200}{8} = -25 (\rightarrow)$$

$$R_2' = -25 (\leftarrow)$$

$$sf = -\frac{(R_1 + R_2)}{(R_1' + R_2')} = 1.125$$

$$BM = BM' + sf \times BM''$$

For paper code A, C, D, see xls files.

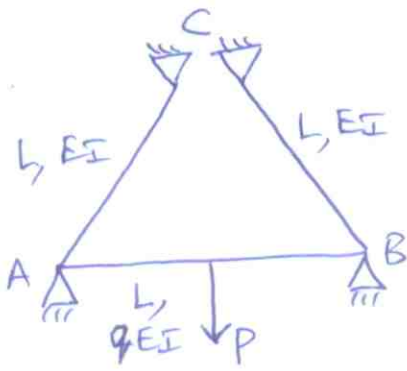
Code B:  $R_1 = 40.91 \leftarrow$   
 $M_A = 37.5 \curvearrowright$   
 $M_D = 225 \curvearrowright$

Code C:  $R_1 = 61.36 \leftarrow$   
 $M_A = 72 \curvearrowright$   
 $M_D = -360 \curvearrowright$

Code A:  $R_1 = 20.45 \leftarrow$   
 $M_A = 11.32 \curvearrowright$   
 $M_D = 101.89 \curvearrowright$

Code D:  $R_1 = 81.82 \leftarrow$   
 $M_A = 133.33 \curvearrowright$   
 $M_D = 533.33 \curvearrowright$

P2



C → pin, A, B are continuous supports.  
 $0 \neq \theta_{CL} = -\theta_{CR}$  due to symmetry  
 $\theta_A = -\theta_B$  " " "  
 No sway (whether symmetry or not).

(2)

Case A:  $\eta = 2$

$$EI \begin{bmatrix} 3+4 \times 2 & 2 \times 2 \\ & \end{bmatrix} \begin{Bmatrix} \theta_A \\ \theta_B \end{Bmatrix} = \begin{Bmatrix} PL/8 \\ \end{Bmatrix} \rightarrow \text{use } \theta_B = -\theta_A$$

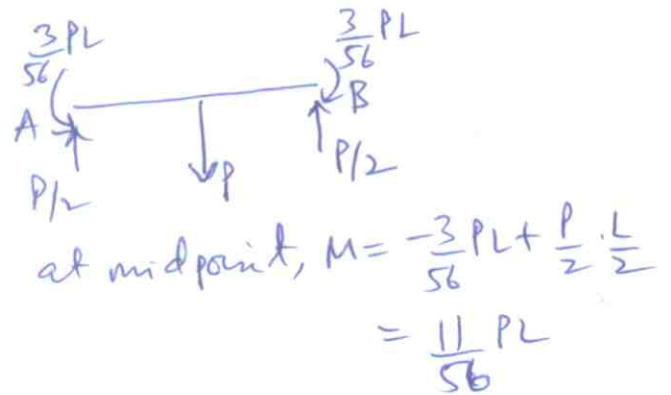
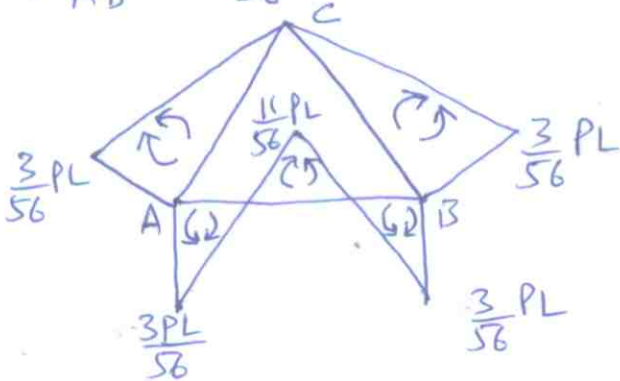
not required

$$\Rightarrow \frac{EI}{L} (11-4) \theta_A = \frac{PL}{8}$$

$$\theta_A = \frac{PL^2}{EI} \cdot \frac{1}{56}$$

$$M_{AC} = \frac{3EI}{L} \theta_A = \frac{3}{56} PL$$

$$\Rightarrow M_{AB} = -\frac{3}{56} PL$$



For Case B:  $\theta_A = \frac{PL^2}{EI} \cdot \frac{1}{72}$ ,  $M_{AC} = M_{BA} = -M_{AB} = -M_{BC} = \frac{3}{72} PL$   
 at mid-pt,  $M = \frac{5}{24} PL$

Case C:  $\theta_A = \frac{PL^2}{EI} \cdot \frac{1}{88}$ ,  $M_{AC} = M_{BA} = -M_{AB} = -M_{BC} = \frac{3}{88} PL$   
 at mid-pt,  $M = \frac{19}{88} PL$

Case D:  $\theta_A = \frac{PL^2}{EI} \cdot \frac{1}{104}$ ,  $M_{AC} = M_{BA} = -M_{AB} = -M_{BC} = \frac{3}{104} PL$   
 at mid-pt,  $M = \frac{23}{104} PL$

CE317 Quiz-1 2013												
Problem1	Code A											
	ab	ba	bc	cb	cd	dc		Load	EI	L		
k	1	1	0.5	0.5	3	3		50	3	8		
mod-stiff	1	1	0.375			2.25						
df		0.727273	0.272727									
fem	0	0	-150	0	0	0						
dist, co	54.54545	109.0909	40.90909	0	0	0		Ax1	R11	Dx1	R21	
BM1	54.54545	109.0909	-109.091	0	0	0		20.45455	20.45455	0	0	
fem	-100	-100	0	0	0	-150						
dist,co	36.36364	72.72727	27.27273	0	0	0		Ax2	R12	Dx2	R22	
BM2	-63.6364	-27.2727	27.27273	0	0	-150		-11.3636	-11.3636	-18.75	-18.75	
BM	11.32075	90.56604	-90.566	0	0	101.887						
								Sf				
								0.679245				

CE317 Quiz-1 2013												
Problem1	Code B											
	ab	ba	bc	cb	cd	dc		Load	EI	L		
k	1	1	0.5	0.5	4	4		100	4	8		
mod-stiff	1	1	0.375			3						
df		0.727273	0.272727									
fem	0	0	-300	0	0	0						
dist, co	109.0909	218.1818	81.81818	0	0	0		Ax1	R11	Dx1	R21	
BM1	109.0909	218.1818	-218.182	0	0	0		40.90909	40.90909	0	0	
fem	-100	-100	0	0	0	-200						
dist,co	36.36364	72.72727	27.27273	0	0	0		Ax2	R12	Dx2	R22	
BM2	-63.6364	-27.2727	27.27273	0	0	-200		-11.3636	-11.3636	-25	-25	
BM	37.5	187.5	-187.5	0	0	-225						
								Sf				
								1.125				

CE317 Quiz-1 2013												
Problem1	Code C											
	ab	ba	bc	cb	cd	dc		Load	EI	L		
k	1	1	0.5	0.5	5	5		150	5	8		
mod-stiff	1	1	0.375			3.75						
df		0.727273	0.272727									
fem	0	0	-450	0	0	0						
dist, co	163.6364	327.2727	122.7273	0	0	0		Ax1	R11	Dx1	R21	
BM1	163.6364	327.2727	-327.273	0	0	0		61.36364	61.36364	0	0	
fem	-100	-100	0	0	0	-250						
dist,co	36.36364	72.72727	27.27273	0	0	0		Ax2	R12	Dx2	R22	
BM2	-63.6364	-27.2727	27.27273	0	0	-250		-11.3636	-11.3636	-31.25	-31.25	
BM	72	288	-288	0	0	-360						
								Sf				
								1.44				

CE317 Quiz-1 2013											
Problem1	Code D										
	ab	ba	bc	cb	cd	dc		Load	EI	L	
k	1	1	0.5	0.5	8	8		200	8	8	
mod-stiff	1	1	0.375			6					
df		0.727273	0.272727								
fem	0	0	-600	0	0	0					
dist, co	218.1818	436.3636	163.6364	0	0	0		Ax1	R11	Dx1	R21
BM1	218.1818	436.3636	-436.364	0	0	0		81.81818	81.81818	0	0
fem	-100	-100	0	0	0	-400					
dist,co	36.36364	72.72727	27.27273	0	0	0		Ax2	R12	Dx2	R22
BM2	-63.6364	-27.2727	27.27273	0	0	-400		-11.3636	-11.3636	-50	-50
BM	133.3333	400	-400	0	0	-533.333					
								sf			
								1.333333			