F → Flexi T → theory N → not mention
M → mom
S →

16-17 ✓

1 (a) → theory
(b) → Flexi
2 (a) → T
(b) → F/N.
3 (a) → F/N
(b) → F
4 (a) → S
5 (a) → M
(b) → M
6 (a) → M
(b) → M
7 (a) → M
(b) → S
8 (a) → S
(b) → S

S → 4
F → 4
M → 5

15-16 ✓

1 (a) → M
(b) → M
2 (a) S
(b) S
3 (a) S
(b) M
4 (a) M
(b) S
5 (a) F
(b) F
6 (a) F
(b) F
7 (a) F
(b) S
8 (a) N
(b) S

S → 5
F → 5
M → 4

14-15 ✓

1 (a) F
(b) F
2 (a) F
(b) F
3 (a) S
(b) S
4 (a) S
(b) → T
5 (a) T
(b) M
6 (a) M
(b) M
7 (a) S
(b) F
8 (a) S
(b) S

S → 6
F → 5
M → 3

13-14 ✓

1 (a) M
(b)
2 → F
3 → M
4 → F
5 → M
6 → F
7 → M
~~8~~ → S
9 → S
10 → S
11 → S
12 → S
13 → S
14 → F

S → 6
F → 4
M → 4

12-13 ✓

1 (a) M
(b)
2 (a) M
(b) S
3 (a) S
(b) S
4 (a) S
5 (a) F
(b) F/T
6 (a) F
(b) F
7 (a) F
(b) F
8 (a) F.

S → 4
F → 6
M → 2

11-12

1 (a) F
(b) S
2 (a) F
(b) S
~~3~~ (a) N
(b) S
4 → S
5 (a) M
(b) F
6 (a) Scope
(b) M
7 (a) M
8 (a) Scope
(b) —

S → 4
F → 3
M → 3

13 - 14

11 12
10 11
8 9

Nothing is certain.

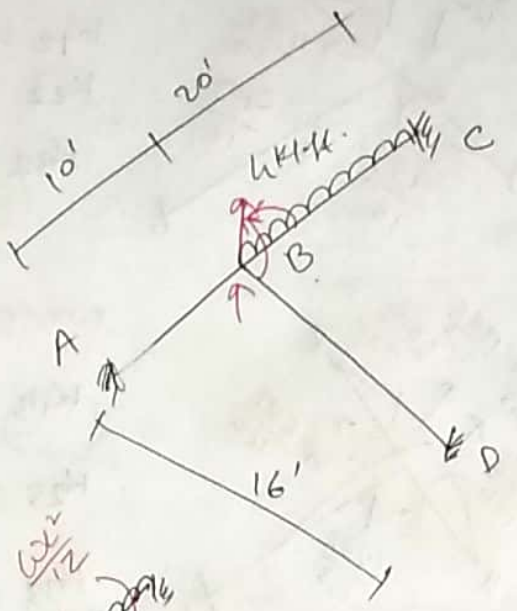
Grid problem

16-17

None

2015-16

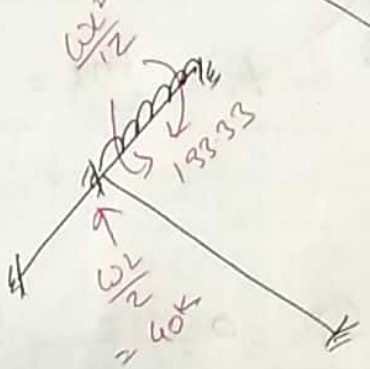
3 (a)

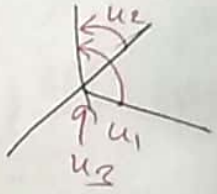


EI = 4000

GJ = 1500

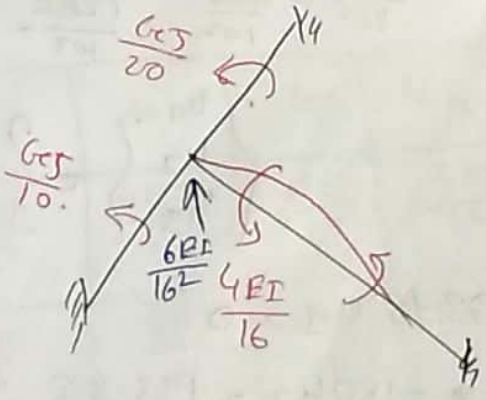
$u_1 = u_2 = u_3 = 0$





$$P_m = \begin{Bmatrix} 0 \\ 133.33 \\ 40 \end{Bmatrix}$$

$u_1 = 1$

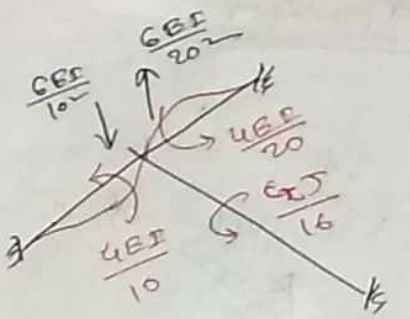


$$K_{11} = \frac{4EI}{16} + \frac{GJ}{20} + \frac{GJ}{10}$$

$$K_{21} = 0$$

$$K_{31} = \frac{6EI}{16^2}$$

$u_2 = 1$

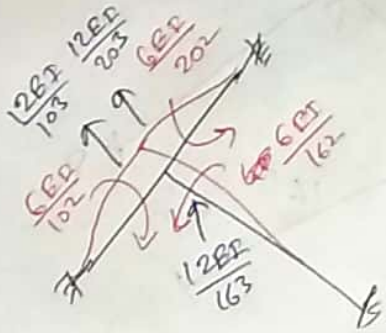


$K_{12} = 0$

$K_{22} = \frac{4EI}{10} + \frac{4EI}{20} + \frac{6J}{16}$

$K_{32} = \frac{6EI}{20^2} - \frac{6EI}{10^2}$

$u_3 = 1$



$K_{13} = \frac{6EI}{16^2}$

$K_{23} = \frac{6EI}{20^2} - \frac{6EI}{10^2}$

$K_{33} = \frac{12EI}{10^3} + \frac{12EI}{20^3} + \frac{12EI}{16^3}$

$P_m + K_u = P_j$

GJ/12

$$\Rightarrow \begin{Bmatrix} 0 \\ 133.33 \\ 40 \end{Bmatrix} + \begin{bmatrix} \frac{4EI}{16} + \frac{4J}{20} + \frac{4J}{10} & 0 & \frac{6EI}{16^2} \\ 0 & \frac{4EI}{10} + \frac{4EI}{20} + \frac{4EI}{16} & \frac{6EI}{20^2} - \frac{6EI}{10^2} \\ \frac{6EI}{16^2} & \frac{6EI}{20^2} - \frac{6EI}{10^2} & \frac{12EI}{10^3} + \frac{12EI}{20^3} + \frac{12EI}{16^3} \end{bmatrix}$$

$EI = 4000$

$GJ = 1500$

$$\begin{Bmatrix} u_1 \\ u_2 \\ u_3 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \\ 0 \end{Bmatrix}$$

$1225u_1 + 0u_2 + 93.75u_3 = 0$

$0u_1 + 3400u_2 - 180u_3 = 133.33$

$93.75u_1 - 180u_2 + 65.72u_3 = 40$

$u_1 = -0.0734$

$u_2 = 0.09$

$u_3 = 0.96$

$\therefore \Delta_B = u_3 = 0.96 \text{ ft} (\uparrow)$

2014-15 None

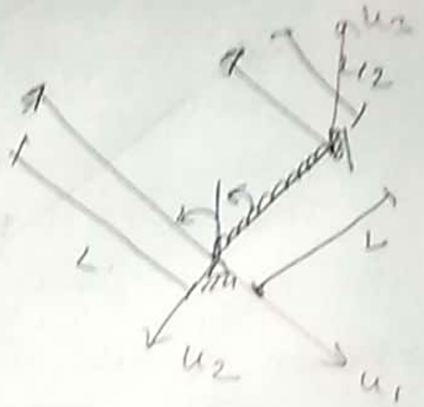
2013-14

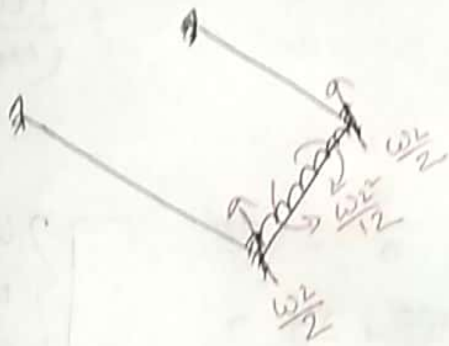
11

Grid problem

DOKI = 3.

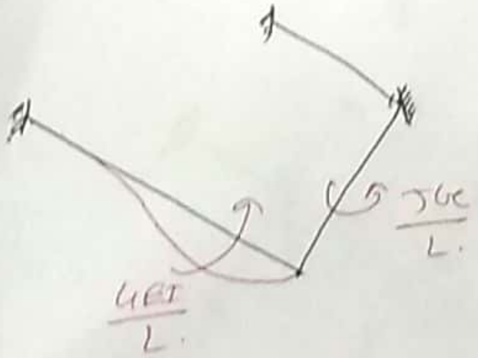
$u_1 = u_2 = u_3 = 0$





$$P_m = \begin{Bmatrix} \frac{wL^2}{12} \\ 0 \\ \frac{wL}{2} \end{Bmatrix}$$

$u_2 = 1$

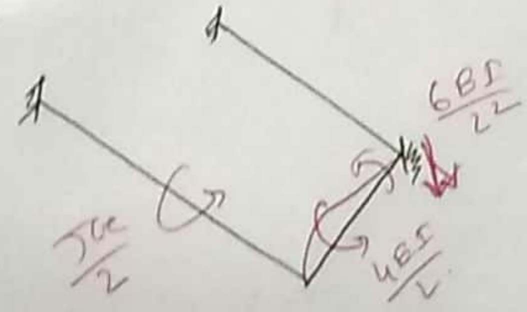


$K_{12} = 0.$

$K_{22} = \frac{4EI}{L} + \frac{JG}{L}$

$K_{32} = 0.$

$u_1 = 1$

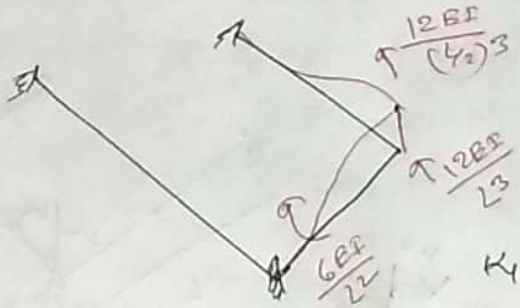


$K_{11} = \frac{4EI}{L} + \frac{JG}{L}$

$K_{21} = 0$

$K_{31} = -\frac{6EI}{L^2}$

$u_3 = 1$



$$K_{13} = -\frac{6EI}{L^2}$$

$$K_{23} = 0$$

$$K_{33} = \frac{12EI}{L^3} + \frac{12EI}{(L/2)^3}$$

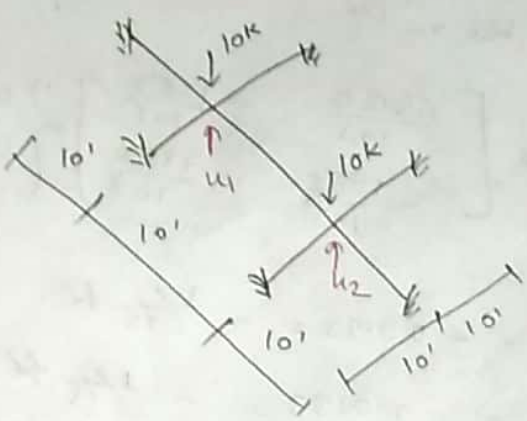
$$P_m + K u = R_j$$

$$\begin{Bmatrix} \frac{wL^2}{2} \\ 0 \\ \frac{wL}{2} \end{Bmatrix} + \begin{bmatrix} \frac{4EI}{L} + \frac{Jk}{L} & 0 & -\frac{6EI}{L^2} \\ 0 & \frac{4EI}{L} + \frac{Jk}{L} & 0 \\ -\frac{6EI}{L^2} & 0 & \frac{12EI}{L^3} + \frac{12EI}{(L/2)^3} \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \\ u_3 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \\ 0 \end{Bmatrix}$$

2012-13

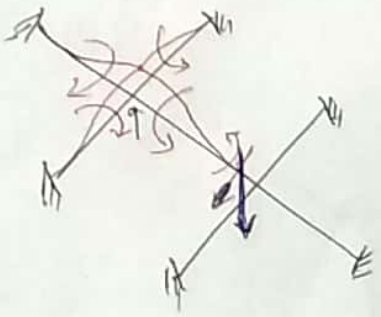
None

2011-12
Q (a)



$P_m = \{0\}_4$ → there is no load on member, only on joints.

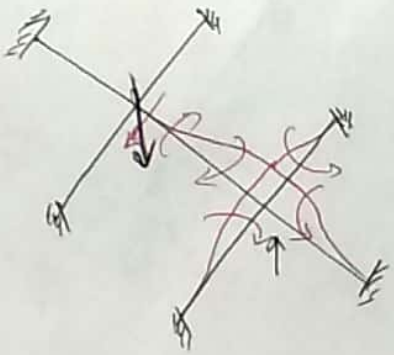
$u_1 = 1$



$K_{11} = \frac{12EI}{10^3} \times 4$ → total 4 bar.

$K_{21} = -\frac{12EI}{10^3}$.

$u_2 = 1$



~~$K_{11} = \frac{12EI}{10^3} \times 12$~~

$K_{12} = -\frac{12EI}{10^3} \times 4$

$K_{22} = \frac{12EI}{10^3} \times 4$.

$$P_m + k u = P_j$$

$$\Rightarrow \begin{Bmatrix} 0 \\ 0 \end{Bmatrix} + \begin{bmatrix} \frac{48EI}{103} & -\frac{12EI}{103} \\ -\frac{12EI}{103} & \frac{48EI}{103} \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \end{Bmatrix} = \begin{Bmatrix} -10 \\ -10 \end{Bmatrix}$$

$u_1 = -0.0133 = -1/75$ ft.

$u_2 = -0.0133 = -1/75$ ft.