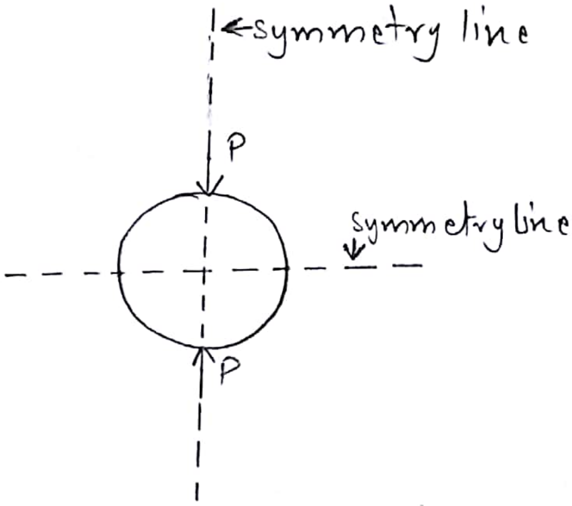
2nd Assignment

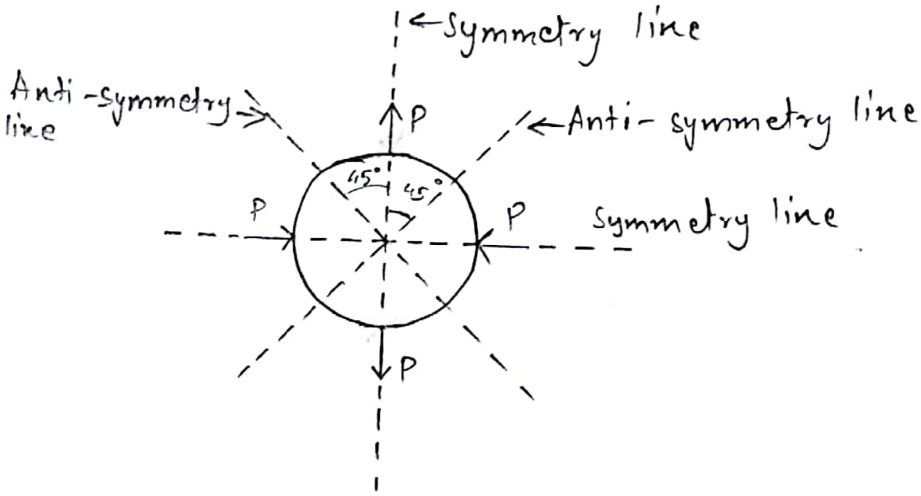
Name:- Sumit Maharjan

Assignment 2.1

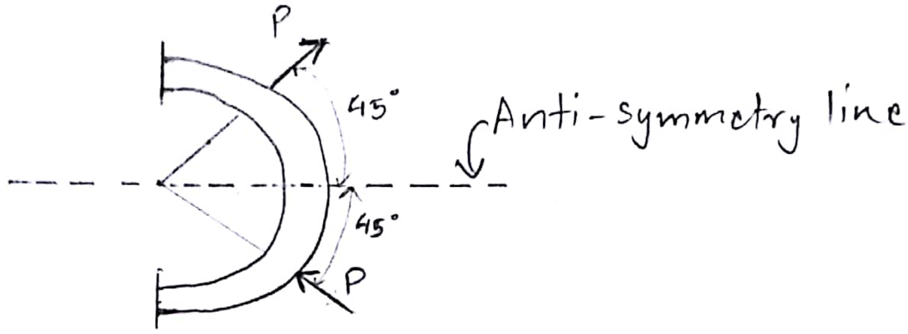
① a)



① b)

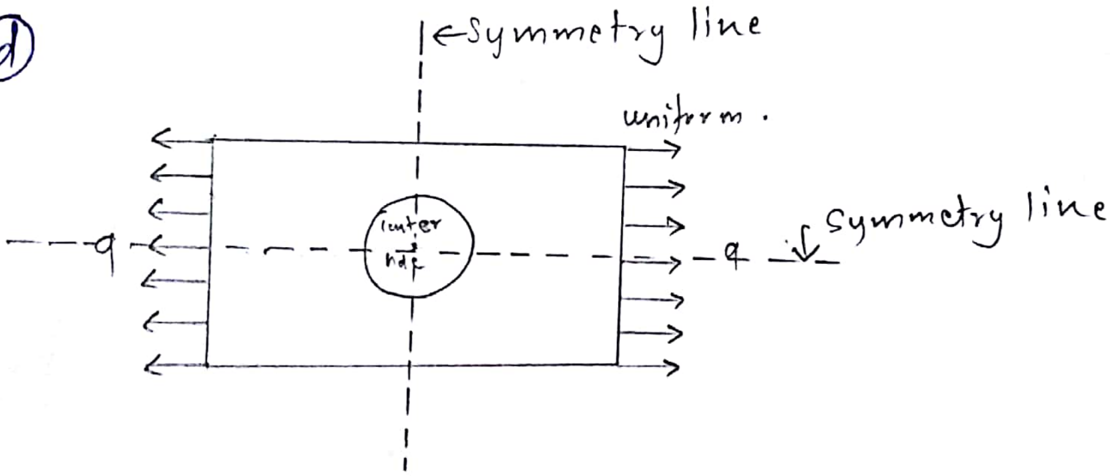


1 c



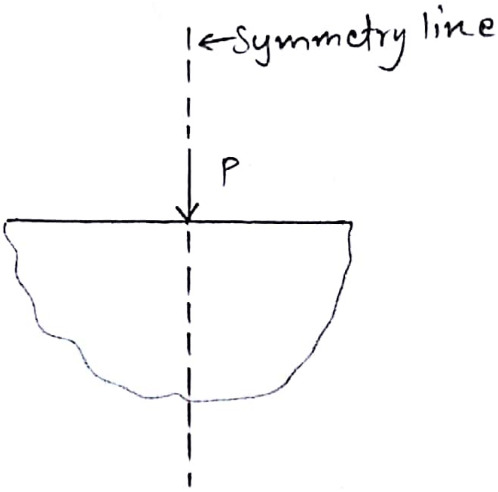
P
45°
Anti-symmetry line
45°
P

1 d



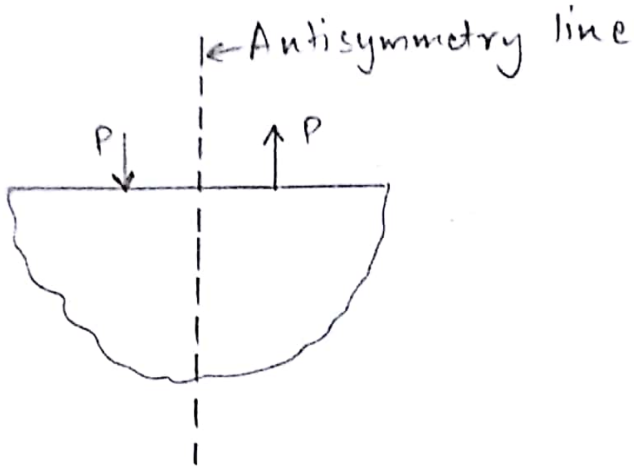
Symmetry line
uniform.
center
q
q
Symmetry line

1 e

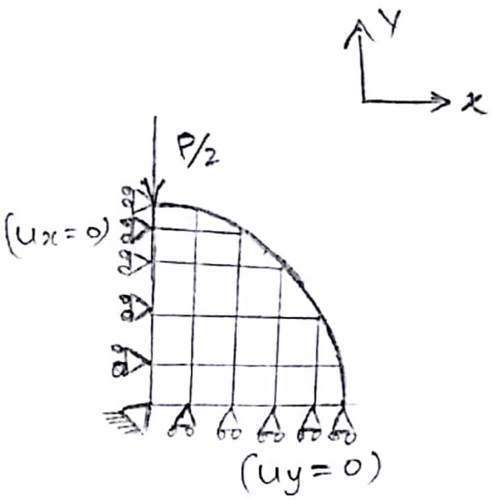


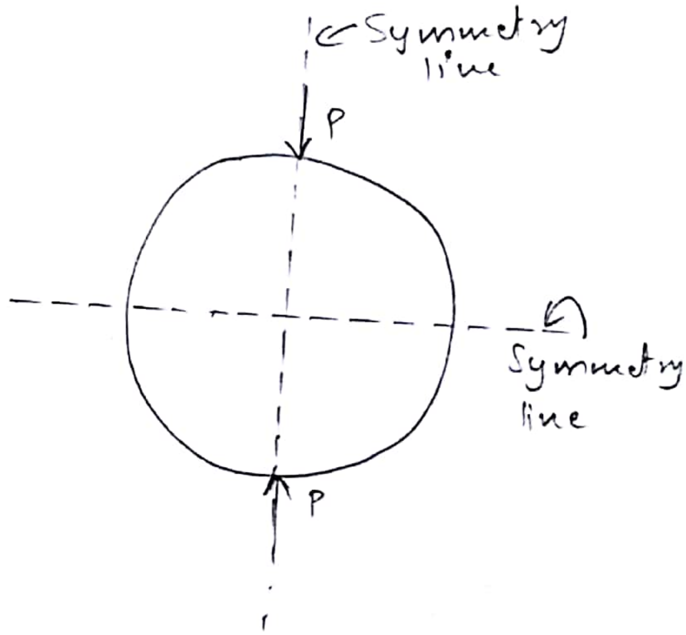
Symmetry line
P

① (f)



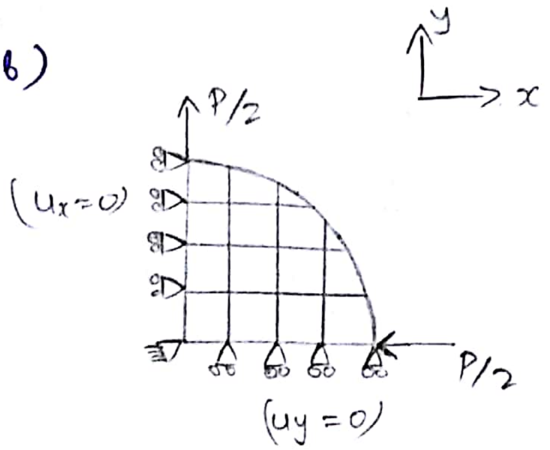
2a)

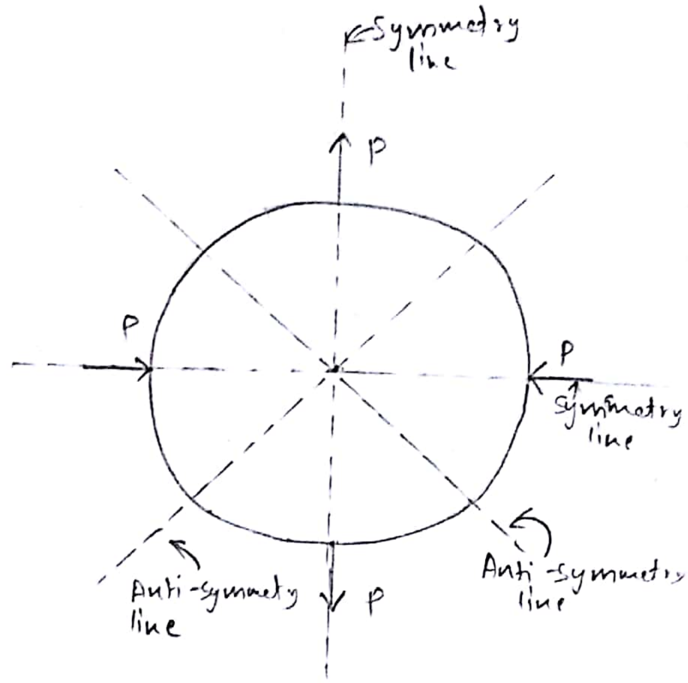




Possible to cut one quarter

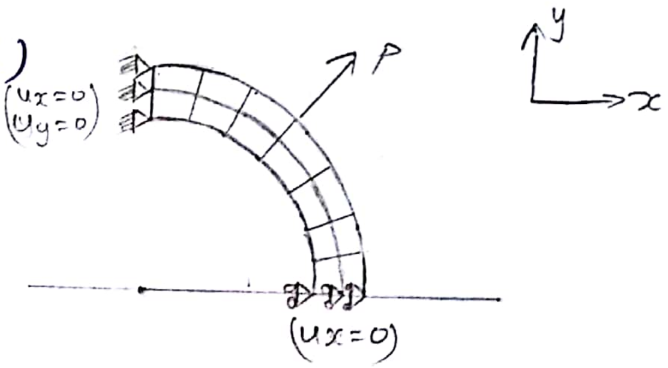
2b)

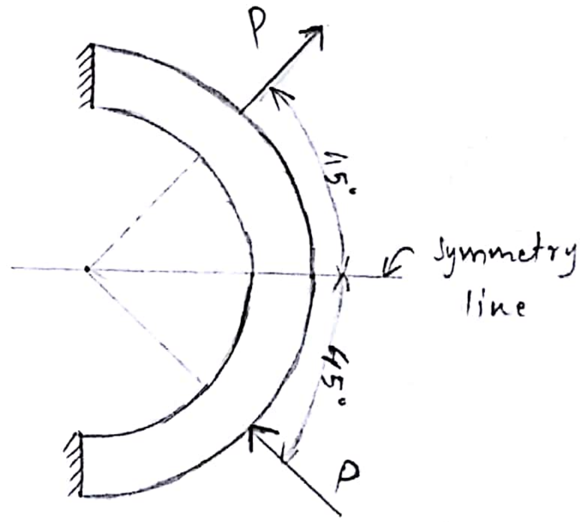




Possible to cut one quarter

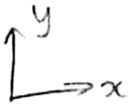
2c)

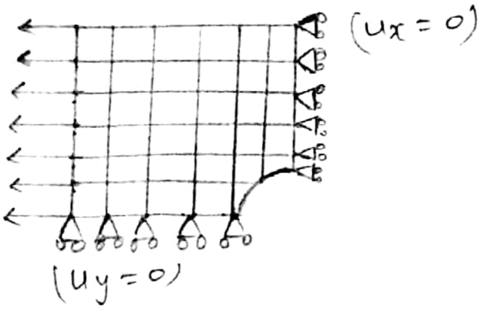


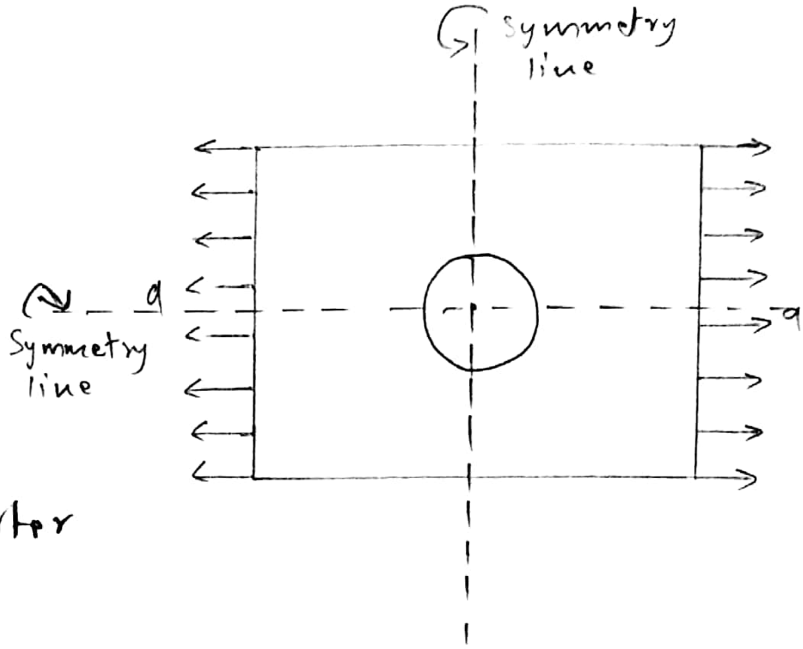


Possible to cut onehalf.

2d)

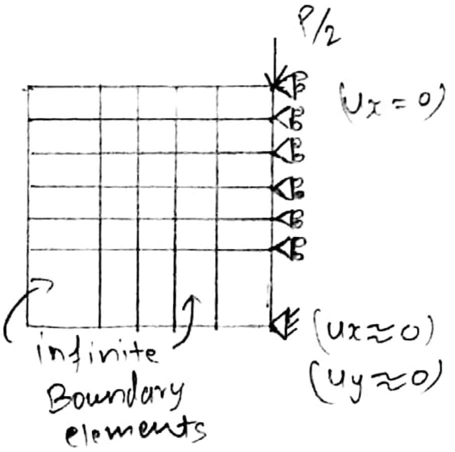


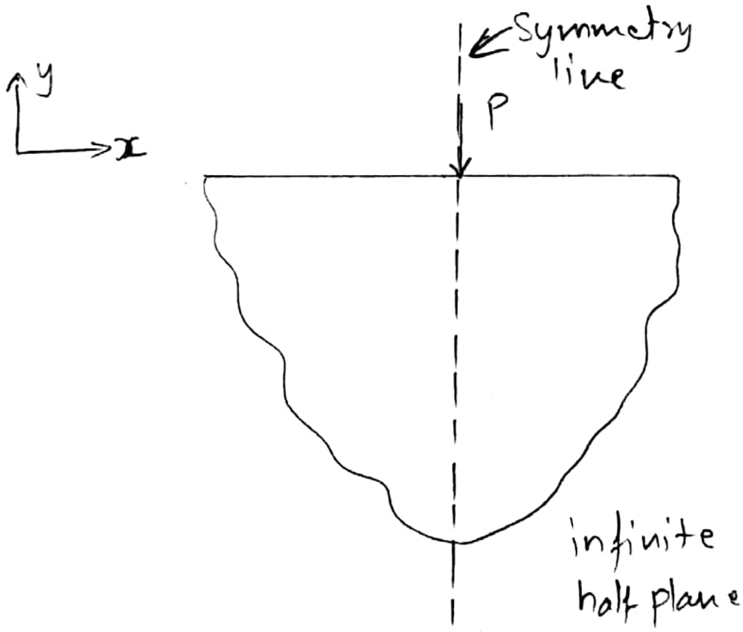




Possible to cut one quarter

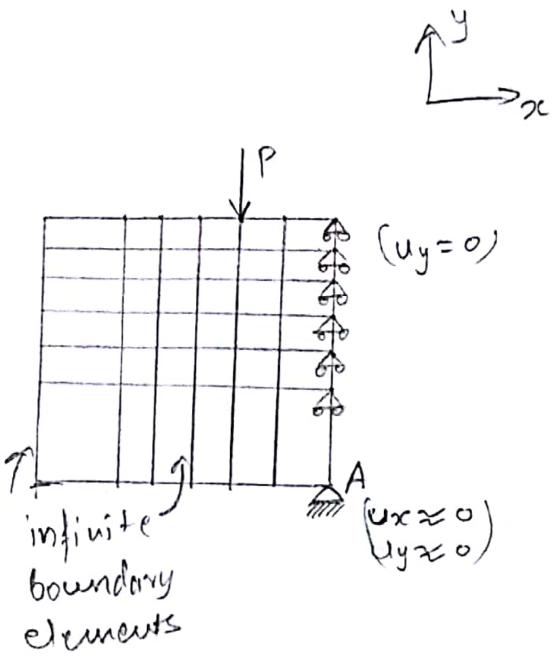
2e)

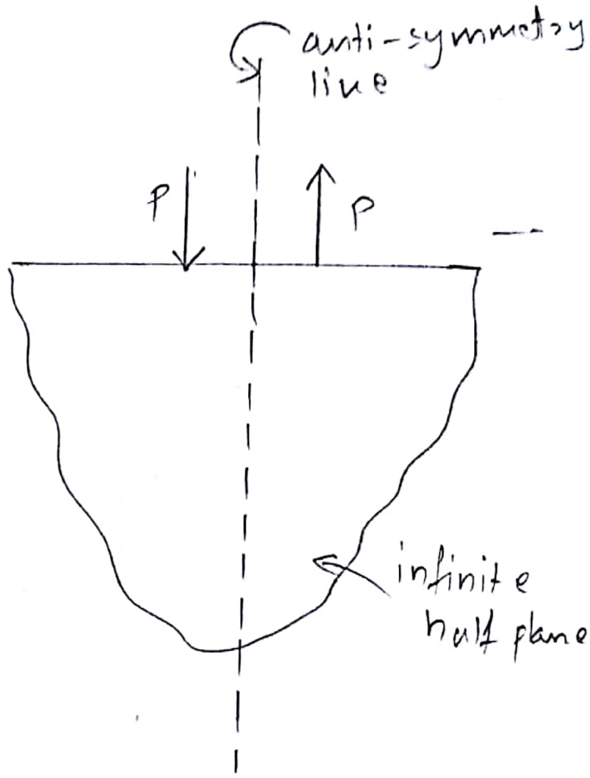




Possible to cut onehalf

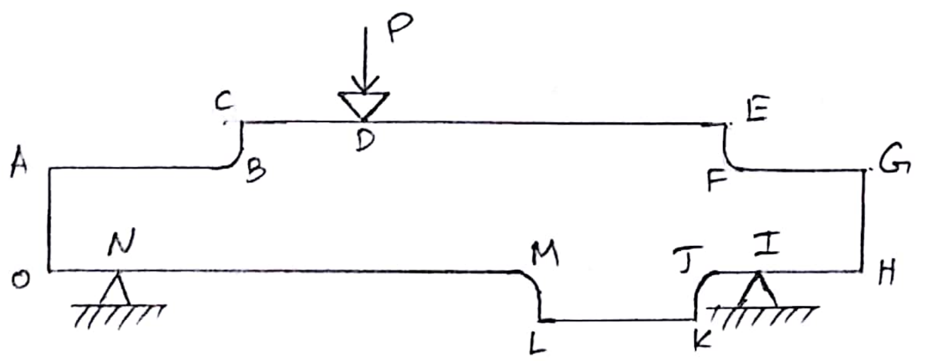
2f)





Possible to cut one half

Assignment 2.2



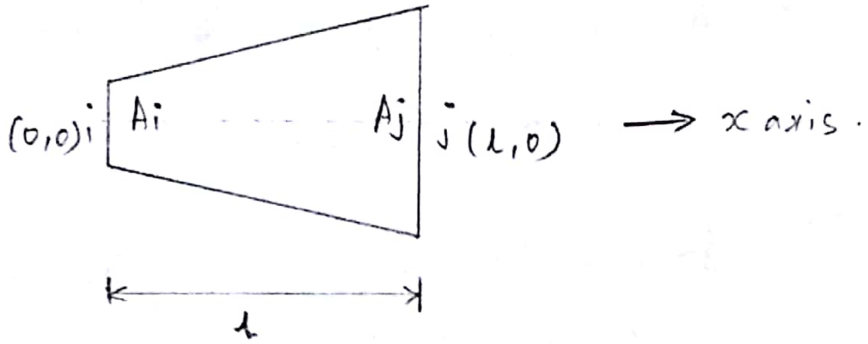
⇒ In the vicinity of D ⇒ Concentrated load

⇒ In the vicinity of N & I ⇒ concentrated Reaction.

⇒ Near B, F, M, & J ⇒ Sharply curved edges

Assignment 2.3

(1)



Given,

$$A = A_i(1-\xi) + A_j\,\xi$$

$\rho \rightarrow$ density

$\omega \rightarrow$ uniform angular velocity (rad/sec) about node $i\,(0,0)$

$q(x) = \rho A \omega^2 x \rightarrow$ centrifugal axial force

We know

$$\xi = (x - x_1)/l$$

$$\xi = (x-0)/l$$

$$x = \xi l$$

⇒ we know for consistent node force

$$\underline{f}^e = \int_0^1 q \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} l\, d\xi$$

$$= \int_0^1 \rho A \omega^2 x \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} l\, d\xi$$

$$= \int_0^1 \rho A \omega^2 \xi l^2 \begin{bmatrix} 1 - \xi \\ \xi \end{bmatrix} d\xi$$

$$= \rho \omega^2 l^2 \int_0^1 (A_i(1-\xi) + A_j \xi) \begin{bmatrix} \xi - \xi^2 \\ \xi^2 \end{bmatrix} d\xi$$

$$= \rho \omega^2 l^2 \int_0^1 \begin{bmatrix} A_i(\xi - \xi^2) + A_j \xi^2) - (A_i(\xi^2 - \xi^3) + A_j \xi^3) \\ A_i(\xi^2 - \xi^3) + A_j \xi^3 \end{bmatrix} d\xi$$

$$= \rho \omega^2 l^2 \int_0^1 \begin{bmatrix} A_i(\xi - \xi^2) + A_j \xi^2) - A_i(\xi^2 - \xi^3) - A_j \xi^3 \\ A_i(\xi^2 - \xi^3) + A_j \xi^3 \end{bmatrix} d\xi$$

$$= \rho \omega^2 l^2 \begin{bmatrix} A_i\left(\frac{\xi^2}{2} - \frac{\xi^3}{3}\right) + A_j \frac{\xi^3}{3} - A_i\left(\frac{\xi^3}{3} - \frac{\xi^4}{4}\right) - A_j \frac{\xi^4}{4} \\ A_i\left(\frac{\xi^3}{3} - \frac{\xi^4}{4}\right) + A_j \frac{\xi^4}{4} \end{bmatrix}_0^1$$

$$= \rho \omega^2 l^2 \begin{bmatrix} A_i\left(\frac{1}{2} - \frac{1}{3}\right) + A_j \frac{1}{3} - A_i\left(\frac{1}{3} - \frac{1}{4}\right) - A_j \frac{1}{4} \\ A_i\left(\frac{1}{3} - \frac{1}{4}\right) + A_j \frac{1}{4} \end{bmatrix}$$

$$= \rho \omega^2 l^2 \begin{bmatrix} A_i\left(\frac{3-2}{6}\right) + A_j\left(\frac{1}{3} - \frac{1}{4}\right) - A_i\left(\frac{4-3}{12}\right) \\ A_i\left(\frac{4-3}{12}\right) + A_j \frac{1}{4} \end{bmatrix}$$

$$= \rho \omega^2 l^2 \begin{bmatrix} A_i\left(\frac{1}{6}\right) + A_j\left(\frac{1}{12}\right) - A_i\left(\frac{1}{12}\right) \\ A_i\left(\frac{1}{12}\right) + A_j\left(\frac{1}{4}\right) \end{bmatrix}$$

$$= \rho \omega^2 l^2 \begin{bmatrix} A_i\left(\frac{2-1}{12}\right) + A_j\left(\frac{1}{12}\right) \\ A_i\left(\frac{1}{12}\right) + A_j\left(\frac{1}{4}\right) \end{bmatrix}$$

$$\underline{f}^{(e)} = \rho \omega^2 l^2 \begin{bmatrix} \dfrac{A_i + A_j}{12} \\ \dfrac{A_i + 3A_j}{12} \end{bmatrix}$$

for the prismatic bar $A = A_i = A_j$ (Given)

$$\underline{f}^{(e)} = \rho \omega^2 l^2 \begin{bmatrix} \dfrac{A+A}{12} \\ \dfrac{A+3A}{12} \end{bmatrix}$$

$$\underline{f}^{(e)} = \rho \omega^2 l^2 \begin{bmatrix} \dfrac{A}{6} \\ \dfrac{A}{3} \end{bmatrix}$$