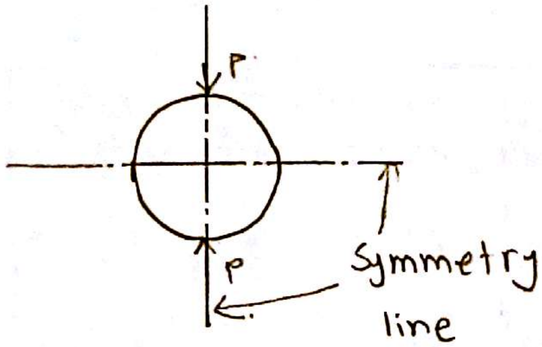
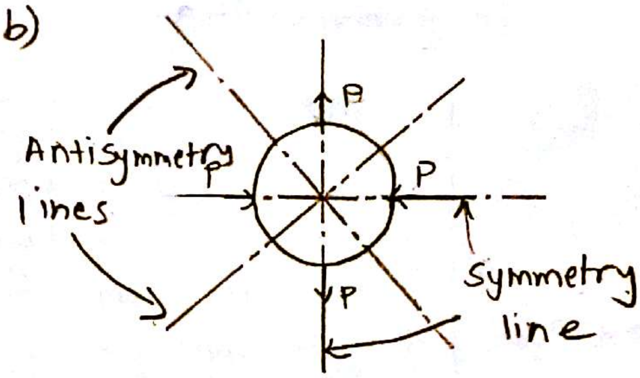
Assignment 2.1

1 Identify the symmetry & antisymmetry lines.

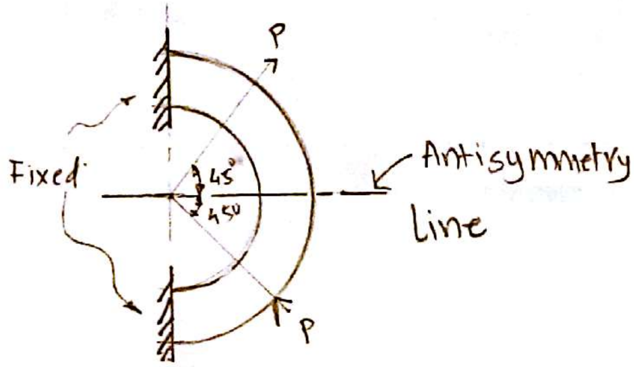
a)



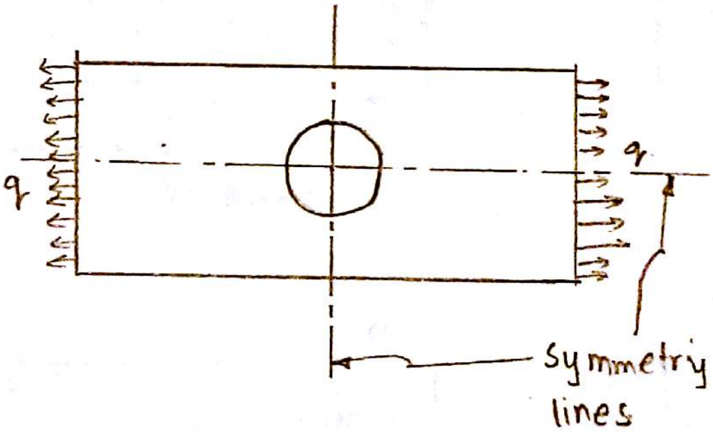
b)



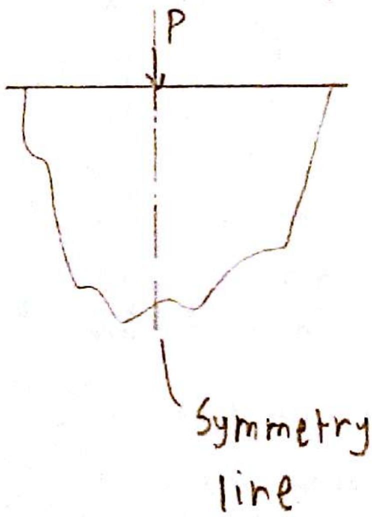
c)



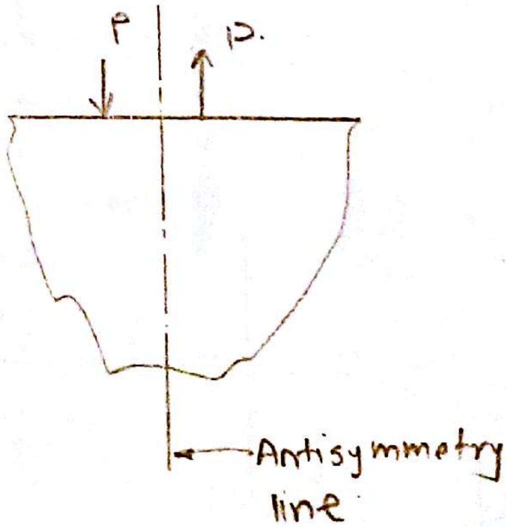
d)



e)

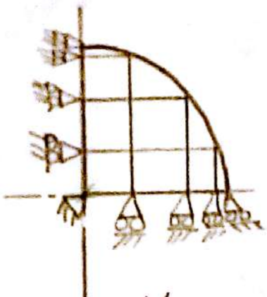


f)



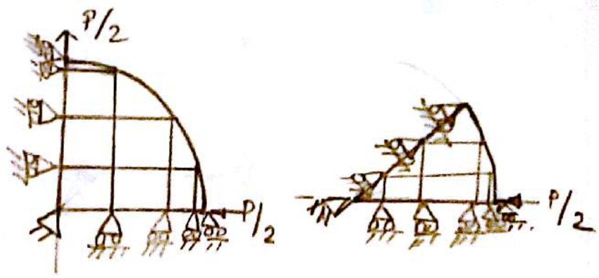
2) Cutting the structure into half / one half

a)



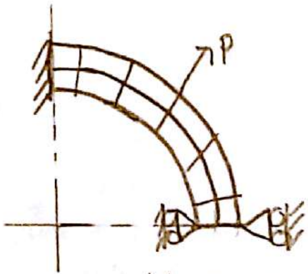
1/4 part.

b)



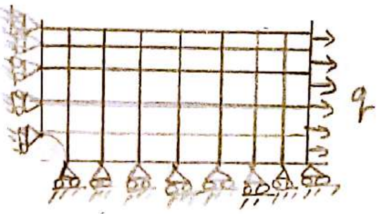
1/4 Part 1/8 Part.

c)



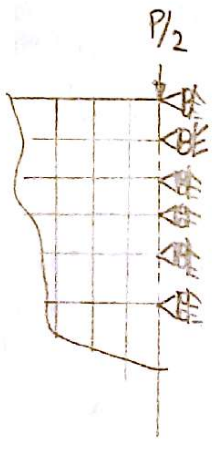
1/2 Part.

d)

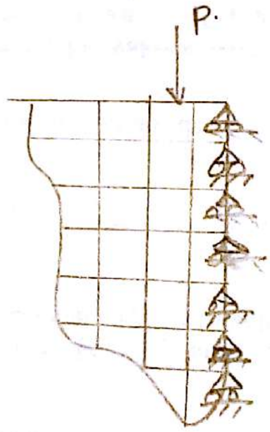


1/4 part

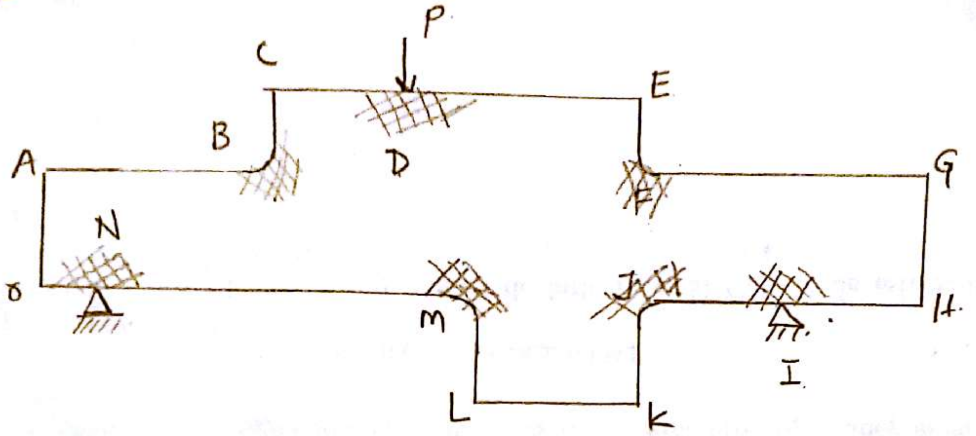
e)



f).



Assignment 2 2



P.t.

P, N I → - Load & Support points
- Concentration of loads in this areas -

B, M, F, J → - sudden change in area, causes stress concentration.

Assignment 2.3

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

$$q(x) = \rho A \omega^2 x$$

$$A = A_i = A_j$$

$$f_{ext} = \int_0^1 q \begin{bmatrix} 1-\xi \\ \xi \end{bmatrix} l\, d\xi$$

where $\xi = \dfrac{x - x_1}{l}$

$x_1 = 0$

$\xi = \dfrac{x}{l}$

$l\xi = x$

$l\, d\xi = dx$

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

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

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

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

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

$$f_{ext} = \rho A l^2 \begin{bmatrix} \dfrac{A_i}{2} - \left(\dfrac{2A_i - A_j}{3}\right) + \dfrac{(A_i - A_j)}{4} \\ A_i\left(\dfrac{1}{3} - \dfrac{1}{4}\right. + \dfrac{A_j}{4} \end{bmatrix}$$

$$f_{ext} = \rho A l^2 \begin{bmatrix} \dfrac{1}{12}(A_i + A_j) \\ \dfrac{A_j}{12} + A_j/4 \end{bmatrix}$$

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For $A = A_i = A_j$

$$f_{ext} = \rho \omega^2 \ell^2 \begin{bmatrix} \frac{1}{12}\left(A + A\right) \\ A\left[\frac{1}{12} + \frac{1}{4}\right] \end{bmatrix}$$

$$f_{ext} = \rho \omega^2 \ell^2 \begin{bmatrix} A/6 \\ A/3 \end{bmatrix}$$