Section - 1

Q1 Boundary conditions

At $r = d/2 = 120/2 = 60\,mm$

(on the inner face, radial pressure $= PH\,pa$ (assume)

Similarly at $r = d/2 = 180/2 = 90\,mm$

(on the outer face), radial pressure

$= 9\,MPa$

So,

$$P = \frac{b}{60^2} - a \quad - (1)$$

and

$$q = \frac{b}{90^2} - a \quad - (2)$$

Eq (1) - Eq (2) gives

$$b = \frac{P - q}{8100 - 3600} (8100 \times 3600)$$

$$b = (P - q)(180 \times 36) \quad - (A)$$

Puting value of b in Eq (2)

$$a = \frac{(P-q)(180 \times \cancel{36})}{\cancel{3600}_{100}} - P$$

$$a = \frac{180P - 1620 - 100P}{100}$$

$$a = \frac{80P - 1620}{100} \quad - (B)$$

Lamis eq for hoops stress

$$\sigma_c = \frac{b}{r^2} \mp a$$

for maximum value fo σ_c (stress) the value of r should be minimum so taking r as inner radius that is $r = 60$ m

$$30 = \frac{(6480P - 58320)}{r^2} + \frac{80P - 1620}{100}$$

$$30 = \frac{(6480P + 2880P) - 116640}{3600}$$

$$108000 = 9360P - 116640$$

$$9360P = 116640 + 108000$$

$$P = 24 \text{ MPa}$$

For radial stress

$$P_r = \frac{b}{r^2} - a$$

$$b = 6480 \times 24 = 58320$$

$$b = 97200$$

$$a = \frac{80 \times 24 - 1620}{100} = 3$$

$$P_r = \frac{97200}{3600} - 3$$

$P_r = 24$

Now for curve b/t hoops stress & radial stress

At $r = 70$ mm

$$\sigma_\theta = \frac{97200}{(70)^2} + 3 = 22.837 \text{ MPa}$$

$$P_r \cancel{\sigma_\theta} = \frac{22.837}{(70)^2} - 3$$

$P_r = 16.837$ MPa

At $r = 80$ mm

$$\sigma_\theta = \frac{97200}{(80)^2} + 3$$

$\sigma_\theta = 18.875$ MPa

$$P_r = \frac{97200}{(80)^2} - 3$$

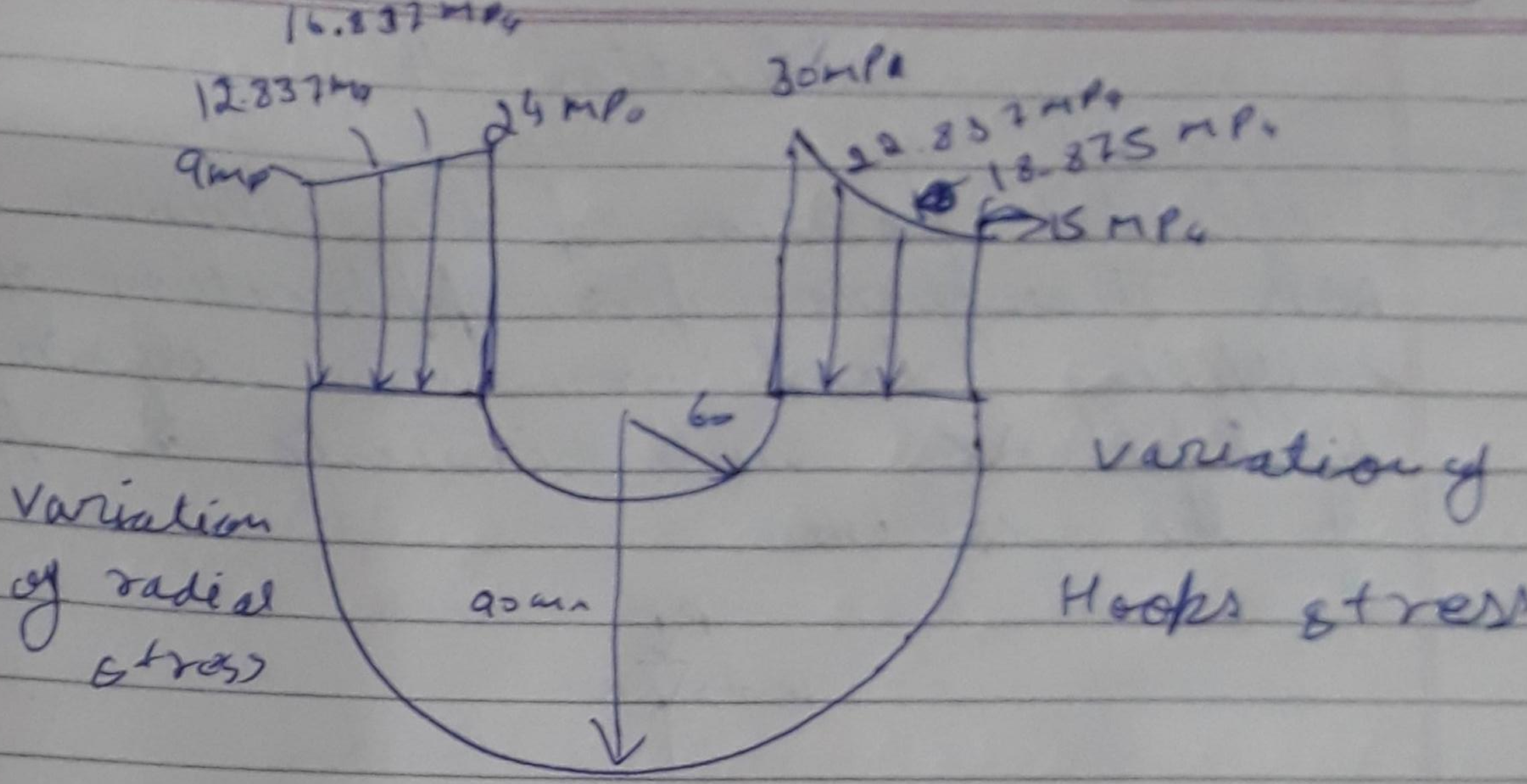
$P_r = 12.875$ MPa

At $r = 90$ mm

$$\sigma_\theta = \frac{97200}{90^2} + 3$$

$\sigma_\theta = 15$ MPa

$$P_r = \frac{97200}{(90)^2} - 3$$


16.837 MPa
12.837 MPa
9 MPa
24 MPa
30 MPa
22.837 MPa
18.875 MPa
15 MPa
60
90 mm
Variation of radial stress
Variation of Hooks stress