SECTION-1

Q1

Ans Boundary Conditions

At $r = d/2 = 120/2 = 60mm$ (on the inner face),
radial pressure = PH pa (assume)

similarly at $r = d/2 = 180/2 = 90mm$
(on the outer face), radial pressure
= 9MPa

So

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

and

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

Eq. (1) – Eq (2) given

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

$$b = (P-q)(180 \times 36) \text{ —— A}$$

putting value of b in eq (2)

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

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

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

Lam's eq for hoops stress

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

for maximum value of σ_c (stress) the value of r should be minimum. So, taking r as inner radius that is $r = 60mm$

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

$$30 = \frac{6480P - 58320}{3600} + \frac{80P - 1620}{100}$$

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

$$108000 = 9360P - 116640$$

$$9360P = 116640 + 108000$$

$$P = 24MPa$$

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 curse b/t hoops stress & radial stress

At $r = 70mm$

$$\sigma_c = \frac{97200}{(70)^2} + 3$$

$$\sigma_c = 22.837 \text{ MPa}$$

$$P_r = \frac{97200}{(70)^2} - 3$$

$$P_r = 16.837 \text{ MPa}$$

At $r = 80mm$

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

$$\sigma_c = 18.875 \text{ MPa}$$

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

$$P_r = 12.875 \text{ MPa}$$

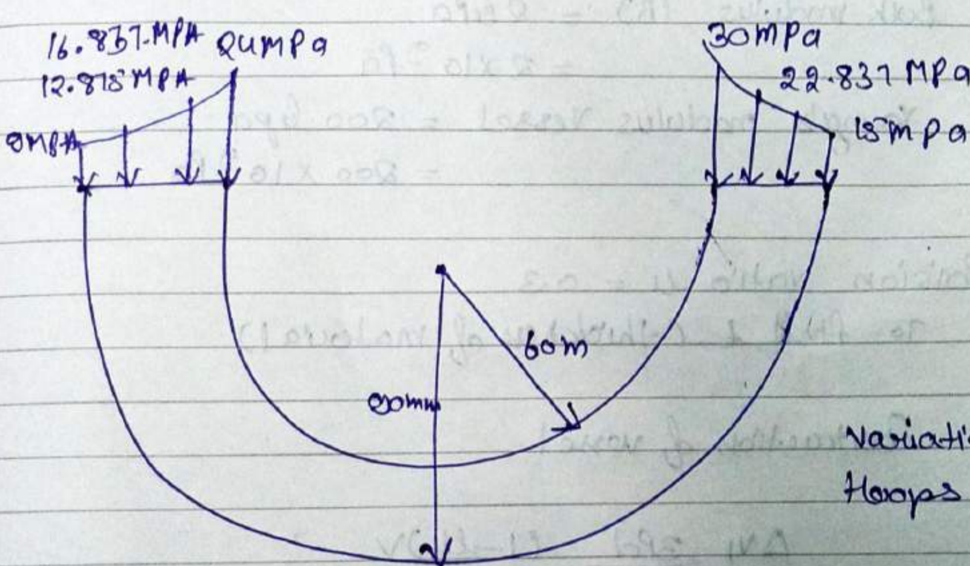
At $r = 90\text{mm}$

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

$$\sigma_\theta = 15 \text{ MPa}$$

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

$$P_r = 9 \text{MPa}$$



Variation of Hoops Stress

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Variation of radial stress