

Ans 1

Factor of Safety :->

$$FOS = \frac{\text{Failure Stress/Load}}{\text{Allowable or working stress}}$$

Allowable stress is the stress value used in design to determine dimensions of component.

FOS depends upon following factors :-

① Effect of failure :-

FOS is taken higher in cases where failure may result in serious accident.

② Type of load :-

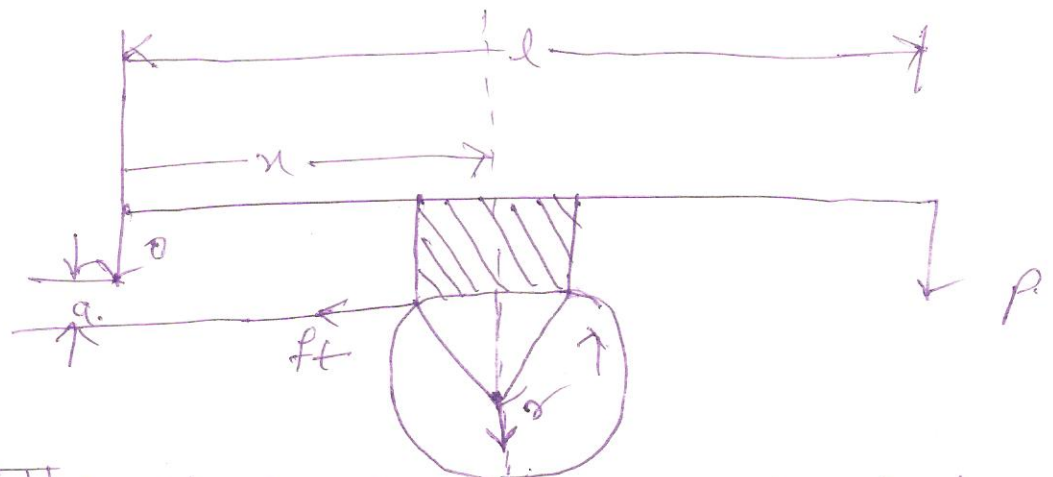
FOS low for static load i.e. $\frac{dF}{dt} = 0$
FOS high // input load.

③ Degree of Accuracy in force Analysis :-

- 4. material of component.
- 5. Reliability // //
- 6. cost // //
- 7. Service conditions
- 8. quality of manufacture.

ANS 2

SELF Energizing Brakes :-



The above case when $l \cos \theta$ of f_t is $'a'$ below f away of $'d'$ when wheel moving. C.C.W.

Take $\theta @ 0$

$$[R \times x = P \times l + f_t \times a]$$

As moment of friction forces adds to movement of force. the brakes are said to be self energizing brakes.

When frictional force is great enough to apply brake with no external force, then brake is self-locking brake.

If $\mu \leq \mu_a$, then p will be -ve or zero.

$A = 2$

$d_i = 2400 \text{ mm}$

$p_i = 1 \text{ N/mm}^2 = 1 \text{ MPa}$

$\sigma_t = 77 \text{ MPa}$

$t = 56 \text{ MPa}$

$\sigma_c = 120 \text{ MPa}$

1. LONGITUDINAL Butt joint \rightarrow Triple Riveted butt joint on equal cover plates.

(a) Thickness of Boiler shell :

$t = \frac{p_i \cdot d_i}{2\sigma_t + k} + 1 \text{ mm}$

$= \frac{1 \times 2400}{2 \times 77 + 0.8} + 1$ Let $k = 0.8$

$= 20.40 \text{ mm}$

$= 21 \text{ mm}$

(b) Dia. of Rivet \rightarrow

$A_s + 78 \text{ mm}$

$d = 6\sqrt{t}$

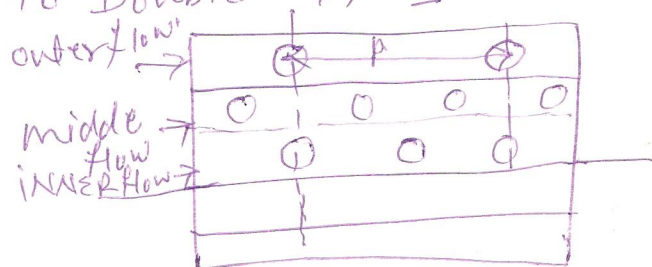
$= 28 \text{ mm}$

(c) Pitch of Rivet :-

By equating $P_s = P_t$

$N_1 =$ Rivets subjected to single shear } Unequal straps.
 $N_2 =$ " " " " to Double " }

$N = 1$, $N_2 = 4$



$$\left[\frac{\pi}{4} d^2 t \right] N_1 + 1.875 \left[\frac{\pi}{4} d^2 t \right] N_2 = (p-d) t \cdot \sigma_t \quad (2)$$

$$\therefore p = \left[N_1 + 1.875 N_2 \right] \frac{\pi d^2 t}{4 \cdot t \sigma_t} + d$$

$$\Rightarrow [1 + 7.5] \cdot \frac{\pi (28)^2 \cdot t}{4 \cdot 21 \cdot \sigma_t} + 28$$

$$= \underline{210 \text{ Nm}}$$

$$\text{As } P_{\max} = (t + 41.28 \text{ Nm})$$

$$= 6(21) + 41.28$$

$$= 167.28$$

$$\text{As } P_{\max} < P$$

$$\therefore P = \underline{167 \text{ Nm}}$$

4. TRANSVERSE PITCH :-

blw outer & middle Row :-

$$P_t = 0.2(167) + 1.15(28)$$

$$= \underline{65.6 \text{ Nm}}$$

blw middle & inner Row :-

$$P_t = 0.167(167) + 0.67(28)$$

$$= \underline{44.65 \text{ Nm}}$$

5. MARGIN :-

$$u = 1.5d$$

$$= 1.5 \times 28$$

$$= \underline{42 \text{ Nm}}$$

6. Thickness of Straps :-

$$\text{Wider Strap } t_1 = 0.75(21)$$

$$= 15.75 \text{ Nm}$$

$$\text{Narrow Strap } t_1 = 0.625t$$

$$= \underline{13.125 \text{ Nm}}$$