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(2.) $L = 1.5 m$ $P = 2500 N$

$b = 150 mm = 0.05 m$

student Number :- ~~100~~ $\boxed{8247531}$
TUVWXYZ

Composite Face sheets :-

$\rho_f = 1500 + 1.0(82)$

$\Rightarrow 2320 \ Kg/m^3$

$E_f = 25 + 84$

$\Rightarrow 109 \ kPa$

$\sigma_f = 500 + 5(75)$

$\Rightarrow 875 \ MPa$

Polymer foam Core :-

$\rho_c \Rightarrow 25 + 5(31)$

$\Rightarrow 180 \ Kg/m^3$

$\sigma_c \Rightarrow 0.3 + 9.2 \left(\frac{31}{100}\right)^{1.5}$

$\Rightarrow 1.888 \ MPa$

$\tau_c \Rightarrow 0.3 + 7.4 \left(\frac{31}{100}\right)^{1.5}$

$\Rightarrow 1.5772 \ MPa$

Failures:-

- Elastic Indentation
- Core Shear
- Face Micro Buckling.

$M \Rightarrow 2bLt\rho_f + bLc\rho_c$

$\Rightarrow 348t + 13.5c$

Elastic Indentation:-

$$P = 2500 \Rightarrow bt\left(\frac{\pi^2 d E_f \sigma_c^2}{3L}\right)^{1/3}$$

$$\Rightarrow b\left(\frac{\pi^2 E_f \sigma_c^2}{3L}\right)^{1/3} \times t \times (t+c)^{1/3}$$

Some Cancellation due to error in calculations earlier. please ignore.

$$\cancel{2500 \Rightarrow (4.7269) \; t \times (t+c)^{1/3}}$$

$$\cancel{(528.88 \times 10^{-6}) = t(t+c)^{1/3}}$$

$$\Rightarrow 2500 = 474.93 \times t \times (t+c)^{1/3}$$

$$\Rightarrow t \times (t+c)^{1/3} - 5.274 = 0$$

Applying $f = (348t + 13.5c)$

$g = \left(t \times (t+c)^{1/3} - 0.5288\right)$

$x \Leftrightarrow t$

$y \Leftrightarrow c$

& $L(x,y,\lambda) = f(x,y) - \lambda\,(g(x,y))$.

& $\nabla L(x,y,\lambda) = 0$; we get ;

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$t \Rightarrow 2.0529$ mm

$c \Rightarrow 14.9026$ mm

~~Mass → 0.163... kg or 163... g~~

Mass $\Rightarrow$ 0.9155943 kg or 915.594 grams

For. Core shear. $\rightarrow$ Neglected as ~~Not~~ $\nabla M = \lambda \nabla P$, not possible

For Micro Buckling $\rightarrow$

$$P \Rightarrow \frac{4b\sigma_f}{L} \times t \times (t+c)$$

$$2500 \Rightarrow 116.667 \times (t(t+c))$$

$$\Rightarrow t(t+c) - 21.428 = 0$$

$t \Rightarrow 0.9300$ mm

$c \Rightarrow 22.1121$ mm

Mass $\Rightarrow$ 0.6556335 kg or $\boxed{655.6335 \text{ g}}$ Min Mass

~~Given the light weight & considerably ... appropriate ... values of t & c, we can use the~~

The Ratio of σ_f to σ_c is quite on the extreme here & hence using the polymer might not be a good idea. Though the t & c come in quite comparable orders, the failure chance due to the ~~...~~ Elastic Indentation is quite high. There is a fair chance of Core-shear failure for each combination.

```
syms t c lambda
f = (348*t) + (13.5*c);
g = t*((t+c).^(1/3)) - 5.274 == 0; % constraint Eqn for Elastic Indentation
L = f - lambda * lhs(g); % Lagrangian
dL_dt = diff(L,t) == 0; % derivative of L with respect to t
dL_dc = diff(L,c) == 0; % derivative of L with respect to c
dL_dlambda = diff(L,lambda) == 0; % derivative of L with respect to lambda
system = [dL_dt; dL_dc; dL_dlambda]; % system of equations
[t_val, c_val,lambda_val] = solve(system, [t c lambda], 'Real', true) % solve the
system of equations and display the results
results_numeric = double([t_val, c_val, lambda_val]) % show results in a vector of
data type double


%Eqn for Micro-Buckling : t*((t+c)) - 21.428
```