Question 3

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15/15

Question 3 :-

Given weight of stand = 250 KN.

mass = $\frac{250 \times 10^3}{9.81}$ = 25484.2 kg.

Load = 10×10^3 N.

deflection = 2.5×10^{-3} m

$\therefore k = P/\delta = \frac{10 \times 10^3}{2.5 \times 10^{-3}}$

$= 4 \times 10^6$ N/m.

$\therefore \omega_n = \sqrt{k/m} = 12.52$ rad/s.

(b) Given PGA = 0.4g.

(i) This means we design it for elastic purposes i.e $\mu = 1$.

from the design spectrum of PSA, we get the design A

Now, $\omega_n = 12.52$ rad/s.

$T_n = 2\pi/\omega_n$

$= 0.502$ sec.

for $T_n = 0.502$, $A = 2.9 \times 9.81$ m/s^2,

$U_0 = 6 \text{ in} \times 0.4 \times 0.0254$

$U_0 = 0.061$m

$\therefore$ Design lateral force

$= mA \times 0.4$

$= 25484.2 \text{kg} \times 2.9 \times 9.81 \times 0.4$

$= 290$ KN

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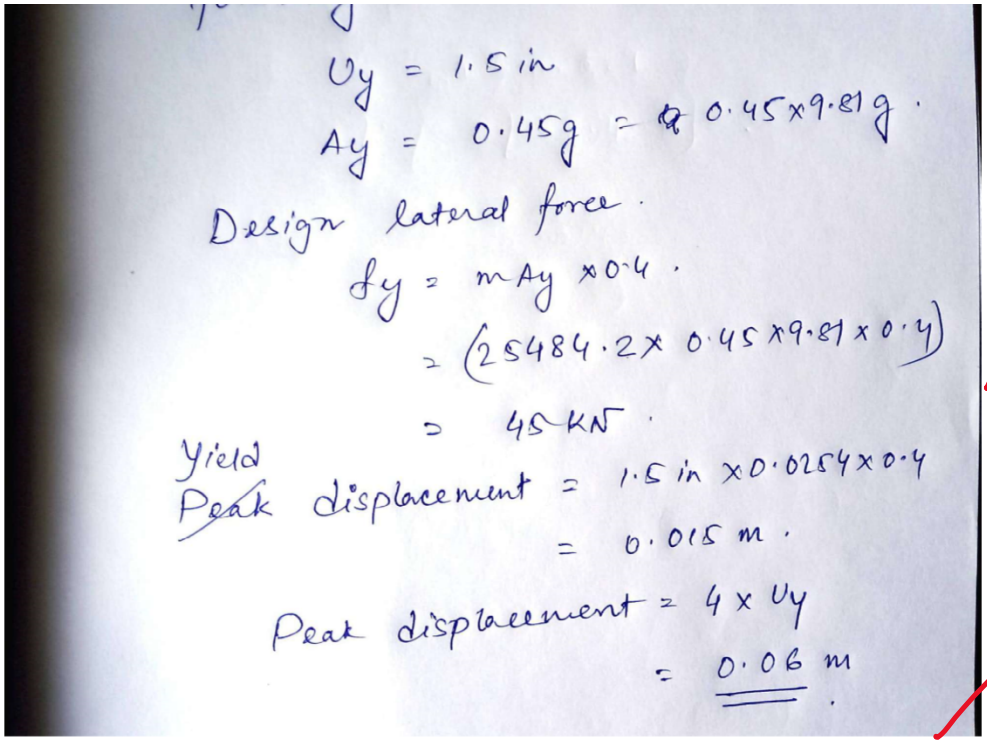
(ii) $v_m = 4 v_y$

$\Rightarrow \mu = \frac{v_m}{v_y} = 4$.

following $\mu = 4$ curve for $t_n = 0.5$s.



$U_y = 1.5$ in

$A_y = 0.45g = 0.45 \times 9.81\ g$.

Design lateral force.

$f_y = m A_y \times 0.4$.

$= (25484.2 \times 0.45 \times 9.81 \times 0.4)$

$= 45$ KN.

Yield

Peak displacement $= 1.5$ in $\times 0.0254 \times 0.4$

$= 0.015$ m.

Peak displacement $= 4 \times U_y$

$= 0.06$ m.