

## Question 3

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Question 3 :-

Given weight of stand = 250 kN.

$$m_{\text{std}} = \frac{250 \times 10^3}{9.81} = 25484.2 \text{ kg.}$$

Load =  $10 \times 10^3 \text{ N.}$

deflection =  $2.5 \times 10^{-3} \text{ m.}$

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

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

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

(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,  $\omega_n = 12.52 \text{ rad/s.}$

$$T_n = \frac{2\pi}{\omega_n}$$

$$= 0.502 \text{ sec.}$$

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

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

$U_0 = 0.061 \text{ m}$   $\therefore$  Design lateral force

$$= m A \times 0.4$$

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

$$= (290 \text{ kN})$$

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(ii)  $U_m = 4 U_y$

$$\Rightarrow \mu = \frac{U_m}{U_y} = (4)$$

following  $\mu = 4$  curve for  $T_n = 0.55$ .

Handwritten calculations on a piece of paper, showing the determination of design lateral force and peak displacement. The calculations are as follows:

$$U_y = 1.5 \text{ in}$$
$$A_y = 0.45g = 0.45 \times 9.81g$$

Design lateral force.

$$F_y = m A_y \times 0.4$$
$$= (25484.2 \times 0.45 \times 9.81 \times 0.4)$$
$$= 45 \text{ kN}$$

Yield Peak displacement =  $1.5 \text{ in} \times 0.0254 \times 0.4$

$$= 0.015 \text{ m}$$

Peak displacement =  $4 \times U_y$

$$= \underline{\underline{0.06 \text{ m}}}$$

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