Given Data:-

$E = 1.28$

$V = 1$

$X_{eq} = 0.52$

Solution:

$$P_e = \frac{EV}{X_{eq}} \sin\delta$$

$$P_e = \frac{(1.28)(1)}{0.52} \sin\delta$$

$$= 2.46 \sin\delta$$

$$\delta_0 = 23.95^\circ =$$

$$\delta_0 = 0.4179 \text{ rad}$$

At $t = 3$ cycles $= 0.05$ sec

$$\delta(t) = \frac{W_{sys} P}{4H} t^2 + \delta_0$$

$$\delta_1(0.05s) = \frac{W_{sys} P}{4H} t^2 + \delta_0$$

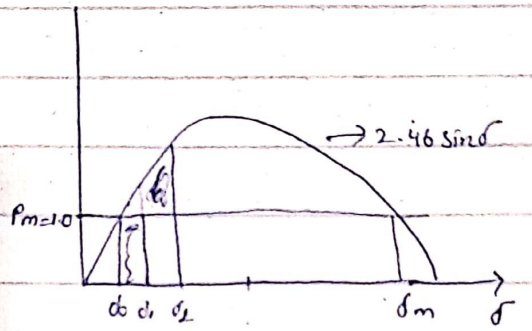
$$= 0.4964$$

$$= 28.44^\circ$$

$$A_1 = \int_{\delta_0}^{\delta_1} P_m \, d\delta$$

$$= \int_{\delta_0}^{\delta_1} 1 \, d\delta = 0.4964 - 0.4179$$

$$\boxed{A_1 = 0.0785}$$



$$A_2 = \int_{\delta_1}^{\delta_2} (P_m \sin\delta - P_m) \, d\delta$$

$$\int_{0.4964}^{\delta_2} (2.4638 \sin\delta - 1) \, d\delta = A_1 = 0.0785$$

$$2.4638 \cos\delta_2 + \delta_2 = 0.0785$$

$$\delta_2 = 0.7003 = 40.12^\circ$$

$$\delta_m = 180 - 23.95 = 156.05 = 2.7236 \text{ rad}$$

Critical Angle:

$$A_1 = \int_{\delta_0}^{\delta_{cr}} P_m \, d\delta = A_2 = \int_{\delta_{cr}}^{\delta_3} (P_{max} \sin\delta - P_m) \, d\delta$$

$$\int_{0.4179}^{\delta_{cr}} 1.0 \, d\delta = A_2 = \int_{\delta_{cr}}^{2.7236} (2.4638 \sin\delta - 1.) \, d\delta$$

$$\delta_{cr} = 1.5489 = 88.74^{0}$$

Critical time:

$$t = \sqrt{\frac{4H}{w_s P_{p.u}} (\delta_{cr} - \delta_0)}$$

$$t = 0.1897 \text{ sec}$$

$$t = 11.38 \text{ cycles}$$