Question 1: Solution

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Q # 1 : Solution | CE 629A | C. Kolay, IITK

$m = 1\ kg, \quad f = 5\ Hz \Rightarrow \omega = 2\pi f = 10\pi\ rad/sec$

$u_g(t) = u_{g0} \sin \omega t$

$\dot{u}_g(t) = \omega u_{g0} \cos \omega t$

$\ddot{u}_g(t) = -\omega^2 u_{g0} \sin \omega t$

$= -\ddot{u}_{g0} \sin \omega t$

$\therefore PGA = \ddot{u}_{g0} = \omega^2 u_{g0}$

Equivalent force acting on the mass $= m \cdot PGA = m\omega^2 u_{g0}$ (because the block is rigid)

The block starts to slip when this force exceeds the friction force F

$\therefore m\omega^2 u_{g0} = F = \mu mg$ μ = coefficient of friction

$\Rightarrow u_{g0} = \mu g/\omega^2 = \dfrac{(0.5)(9.81\ m/s^2)}{(10\pi\ rad/s)^2} = 4.96 \times 10^{-3}\ m = 4.96\ mm$

$\therefore$ **$PGD = u_{g0} = 4.96\ mm$.**