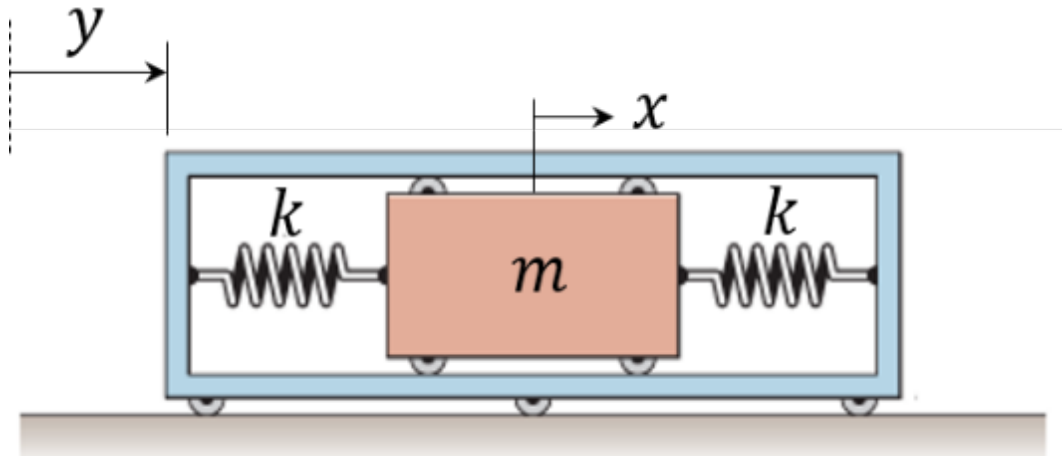

 Vibrations - 1

In the system shown, the motion of the outer frame is given by $y(t) = Y \sin \omega t$.



a) Show the free body diagram and derive the equation of motion of the system in terms of x , the absolute displacement of the mass m . **(30 points)**

b) Find the particular solution
 $x_p(t) = X \sin(\omega t - \phi)$. **(30 points)**

Hint: Find X and ϕ

c) Sketch the displacement transmissibility, $\left| \frac{X}{Y} \right|$, as a function of the frequency ratio $r = \frac{\omega}{\omega_n}$ for $0 < r < 2$ for these three cases

c1) for damping ratio $\xi = 0$ **(10 points)**

c2) Assuming there is damping ratio of $\xi = 10\%$ **(10 points)**

c3) Assuming there is damping ratio of $\xi = 25\%$ **(10 points)**

c4) for what range(s) of r , the mass m experiences smaller amplitude oscillations than the base excitation? **(10 points)**

Hint: The plot axes are given.

