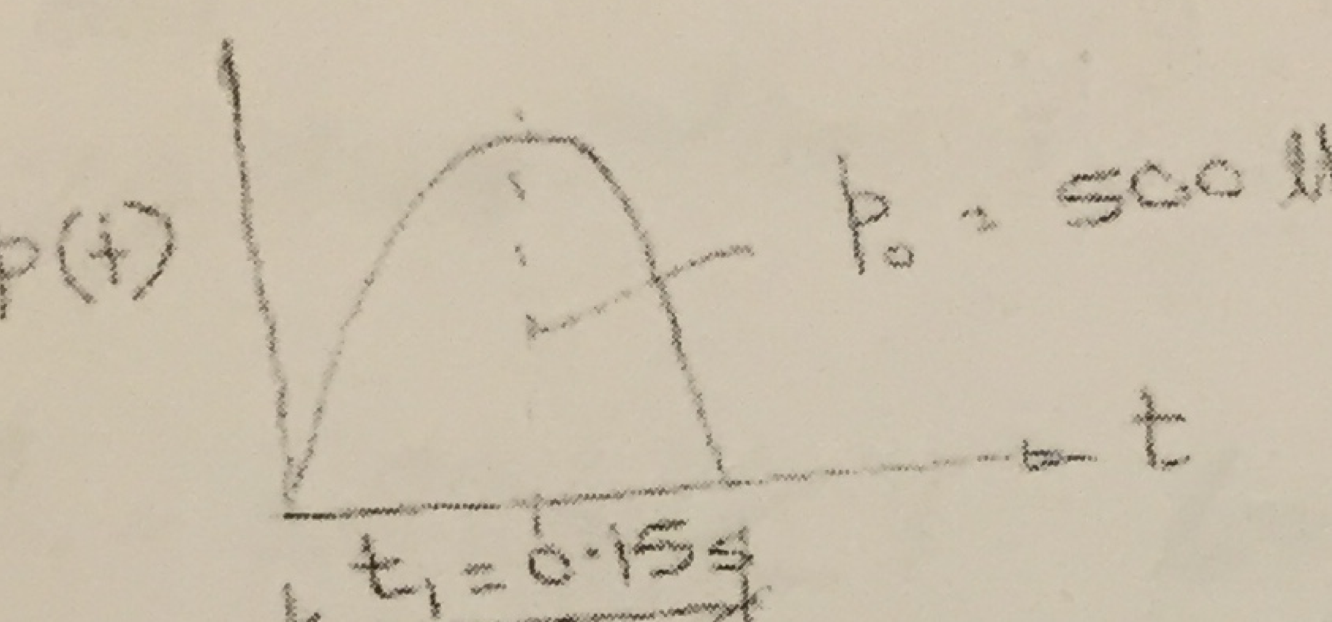
EM 633

HW #5

SDOF

1. Consider the basic dynamic system ~~of Fig. 2-1a~~ with the following properties: $W = 600$ *lb* ($m \triangleq W/g$) and $k = 1{,}000$ *lb/in*. Assume that it is subjected to a half sine-wave impulse ~~(Fig. 5-2)~~ of amplitude $p_0 = 500$ *lb* and duration $t_1 = 0.15$ *sec*. Determine:
   (*a*) The time at which the maximum response will occur.
   (*b*) The maximum spring force produced by this loading; check this result with that obtained by use of Fig. 5-6. (Attached)



2. A triangular impulse that increases linearly from zero to the peak value is expressed as $p(t) = p_0(t/t_1) \quad (0 < t < t_1)$.
   (*a*) Derive an expression for the response of a SDOF structure to this laoding, starting from "at rest" conditions.
   (*b*) Determine the maximum response ratio

$$R_{max} = \frac{v_{max}}{p_0/k}$$

resulting from this loading if $t_1 = 3\pi/\omega$.

3. The water tank of Fig. P5-1*a* can be treated as a SDOF structure with the following properties: $m = 4$ *kips* $\cdot$ *sec*^{2}/*in*, $k = 40$ *kips/in*. As a result of an explosion, the tank is subjected to the dynamic-load history shown in Fig. P5-1*b*. Compute approximately the maximum overturning moment M_0 at the base of the tower using Eq. (5-21) and evaluating the impulse integral by means of Simpson's rule:

$$\int p\, dt = \frac{\Delta t}{3}(p_0 + 4p_1 + 2p_2 + 4p_3 + p_4)$$

$$x(\bar{t}) \simeq \frac{1}{m\omega}\left(\int_0^{t_1} p(t)\,dt\right)\sin\omega\bar{t}$$

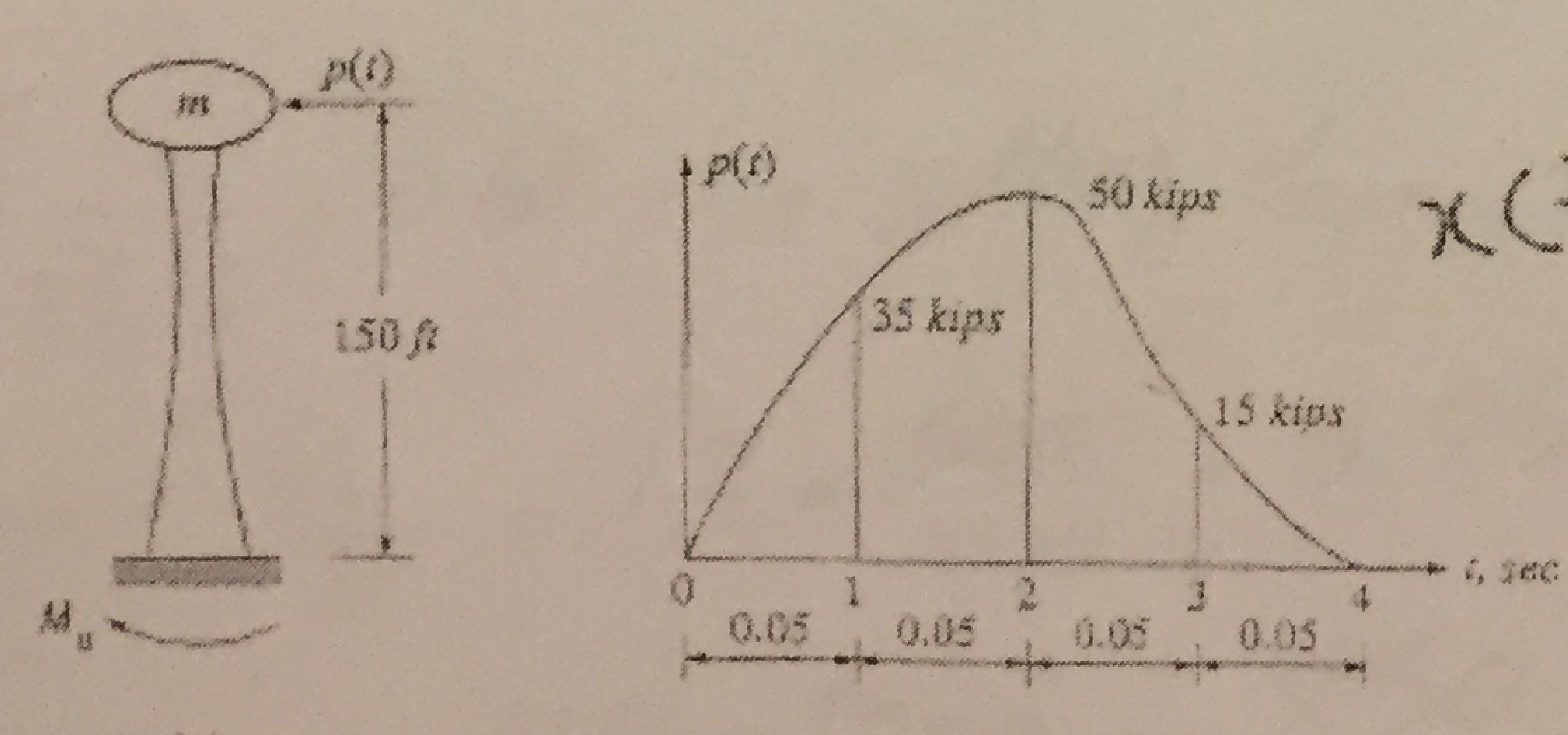


FIGURE P5-1