

MAE 3360 HW #6 (Key Assignment)**Due: 3/26/08****(20 pts each)**

1. A force of 3 N stretches a spring by 1 m. A mass of 4 kg is attached to the spring. At $t=0$ the mass is pulled down a distance 1 m from equilibrium and released with a downward velocity of 0.5 m/s. Assuming that damping is negligible, determine an expression for the position of the mass at time t . Find the circular frequency of the system and the amplitude, phase, and period of the motion.

2. (a) Determine the motion of the spring-mass system governed by

$$\frac{d^2 y}{dt^2} + 5 \frac{dy}{dt} + 6y = 0, y(0) = -1, \frac{dy}{dt}(0) = 4.$$

(a) Find the time at which the mass passes through the equilibrium position, and determine the maximum positive displacement of the mass from equilibrium.

(b) Make a sketch depicting the motion.

3. Consider the damped spring-mass system whose motion is governed by

$$\frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} + 5y = 17 \sin 2t, y(0) = -2, \frac{dy}{dt}(0) = 0.$$

(a) Determine whether the motion is underdamped, overdamped or critically damped.

(b) Determine the solution to the given initial conditions and identify the transient and steady-state parts.

4. Consider the spring-mass system whose motion is governed by

$$\frac{d^2 y}{dt^2} + 3 \frac{dy}{dt} + 2y = 10 \sin t.$$

Determine the steady-state solution, y_p , and express your answer in the form

$$y_p(t) = A_0 \sin(t - \phi),$$

for appropriate constants A_0 and ϕ .