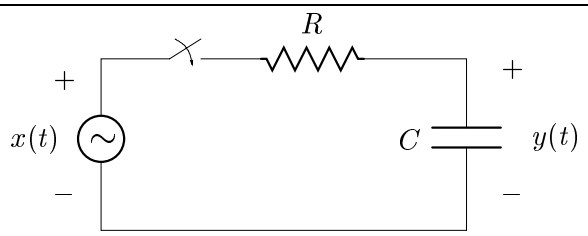
EE 102 **Homework #5** **Fall 2001**

Professor Paganini **Due Wednesday 11/14/01**



1. In the above RC circuit, the switch is closed at time $t = 0$, with the capacitor initially discharged. After that, the sinusoidal voltage $x(t) = \sin(\omega_0 t)$ is applied, where $\omega_0 = \frac{1}{RC}$. Find the output voltage $y(t)$.

2. We are given an LTI system with proper transfer function $H(s)$. The second order denominator has roots (poles) at $s = -1 \pm i$. To determine the numerator, we are given the following information:

   - When the input is $x(t) \equiv 1$ for $t \in (-\infty, \infty)$, the output $y(t) \equiv 2$.
   - When the input is $x(t) = \cos(2t)$ for $t \in (-\infty, \infty)$, the output is zero.

   a) Find $H(s)$.

   b) Now let the input be $x(t) = \sin(2t)u(t)$. Find the output.

3. For the following functions, find out whether they are periodic, and if so, give the period.

   a) $\cos(4t) + \sin(3t - 3)$; b) $e^{\sin(t)}$; c) $\sin(e^t)$.

4. In the periodic function $f(t)$ below, the portion indicated by the arrow is a cosine function. Find the Fourier series expansion $f(t) = \sum_{n=-\infty}^{\infty} F_n e^{in\omega_0 t}$.