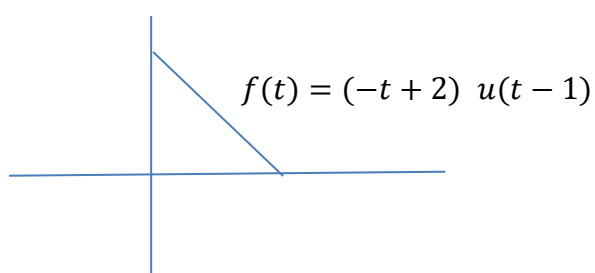


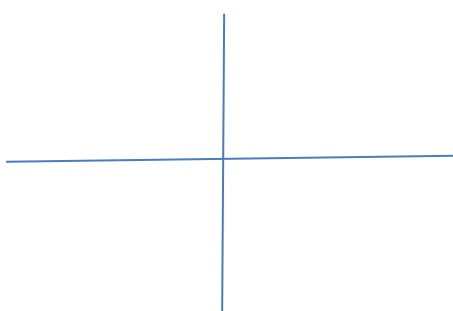
EE103 Final Examination
June 13, 2017 12:00-3:00 p.m.

Name _____ ID _____

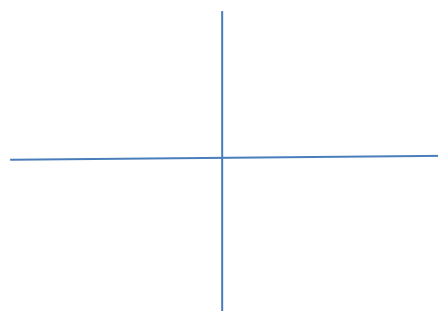
[1]. (10 points) Given $x(t)$ shown below plot its even function $x_e(t)$ and odd function $x_o(t)$. The vertical axis is at $t=1$. The horizontal axis is t -axis.



$x_e(t)$



$x_o(t)$



[2](15 points) For a Linear Time-Invariant System (LTI) with its impulse response function of $h(t)$,

(a)(10 points) Derive an expression for its output $y(t)$ corresponding to a bounded input $x(t)$ as $\int_{-\infty}^{+\infty} x(\tau) h(t - \tau) d\tau$. For each step, explain your reasoning.

[2](b)(5 points) Find and plot $y(t)$ for $x(t) = u(t) - u(t-2)$, $h(t) = (-t+3) u(t-2)$

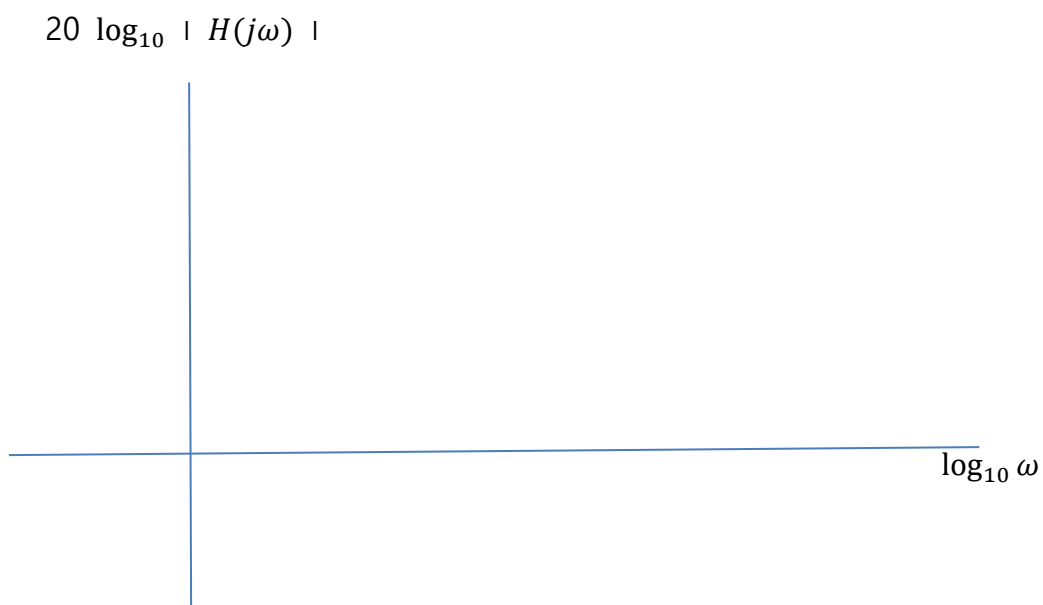
[3](25 points) For $x(t) = 4 \cos 4\pi t + 3 \sin 4\pi t$,

(a)(10points) Express in the form of $x(t) = A \cos(k\pi t + \phi)$. (hint: $\arctan 1 = 45^\circ$, $\arctan 4/5 = 38.66^\circ$, $\arctan 3/5 = 30.96^\circ$)

(b) (5 points) Find $X(s)$, the Laplace transform of $x(t)$

[3](c) (10 points) Find $y(t)$ for $h(t) = e^{-10t} u(t)$ by using the Laplace transform method $Y(s)=H(s)X(s)$ and then taking Inverse Laplace Transform of $Y(s)$.

[4] (20 points) For $H(s) = 100 \frac{s+1000}{(s+10)(s+100)}$ draw its Bode plot using a semi-log graph with appropriate marking of vertical coordinate in dB and horizontal axis in $\log_{10} \omega$. Show all the steps for derivation of Bode plot, in other words show the calculation of $20 \log_{10} |H(j\omega)|$.



[5](20 points) Find Fourier Transform $F(\omega)$ for $f(t) = \text{Cos } 20\pi t \times \text{Rect}(t/T)$,
where $T=100\text{mS}= 0.1\text{S}$.

[6](10 points) Explain the most important subjects or concepts you have learned from EE103 and how you might apply in the future.