EE103 Midterm Examination May 8, 2017

Name_____ ID_____

1.(20 points) True/False question (5 points each). Answer T for true and F for false.

(a). Impulse function $\delta(t)$ has a peak amplitude of 1.0. _____

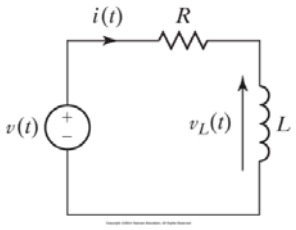
(b). A linear time-invariant (LTI) system characterized by its impulse h(t) produces its output for a given input x1(t) as y1(t)=x1(t) * h(t), where * denotes convolution integral. For x2(t)=x1(t-100), its corresponding output is y2(t)= y1(t-100). _____

(c). If a signal x1(t) is periodic with period T1, another signal x2(t) is periodic with period T2, then x1(t)+x2(t) is also periodic for all T1, T2 as long as they are real numbers including e, π, etc. _____

(d). Sinc πt= (sin πt)/ πt is an odd function of t. _____

2. (20 points) For x(t)= 2 u(t-1) r(t-1), where u(t)=1 for $t \geq 0$, and 0 for t<0, r(t)=t for $t \geq 0$ and 0 for $t < 0$. **Draw the odd function component of x(t).**

3. (30 points) Consider the RL circuit shown below.

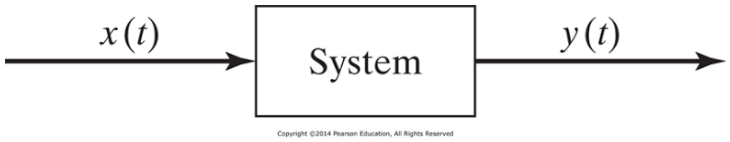


The voltage across R, that is $V_R(t)=R\ i(t)$ is taken as output y(t) for input x(t)=v(t).

(a).(15 points) **Express x(t) in terms of $y(t)=V_R(t)$.**

(b). (15 points) Let R=1Ω, L=1H and x(t)=v(t)= δ(t). **Determine the impulse response h(t).** (hint: Laplace transforform of δ(t) and that of dy(t)/dt is sY(s), that of y(t) is Y(s). Inverse Lapace transform of [a/(s+b)] is [a exp(-bt)].

(4). (30 points) Consider a system with its x(t)-y(t) relationship characterized by h(t).



(a). (15 points) When h(t)=[exp(-2t)-exp(-3t)]u(t) and x(t)=u(t), a unit step function, **find y(t).**

(b). (15 points) For H(jw)= 2/(4+jw), where w=2πf, find y(t) for x(t)= 2sin 3t. You can express y(t) as a sinusoidal function with a phase angle in the form of arctan (a/b) with numerical values of a and b.