Open book/notes (10 questions, 10 points each)

1. (   ) Which of the following is a nonlinear time-varying system?   (A) $y(t)=\sqrt{x(t)}$,
   (B) $y(t)=\sin[x(t)]$,   (C) $y(t)=\sin[x(t)]+t$,   (D) $y(t)=\sin[x(t)]+\cos[x(t)]$,   (E) none of the above.

2. (   ) The impulse response of a LTI system $h(t)$ is shown on the right. The input $x_1(t)$ is a square pulse, which is 1 for $0\le t\le 1$ and 0, otherwise. The output $y_1(t) = ?$

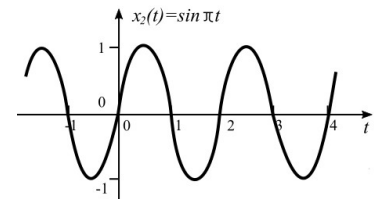   (A)   (B)   (C)   (D)
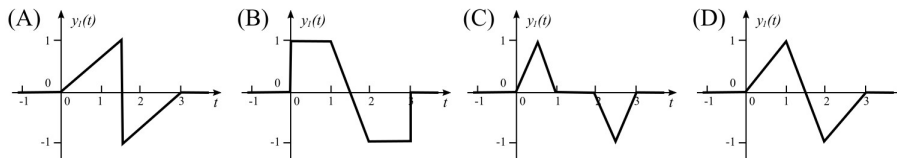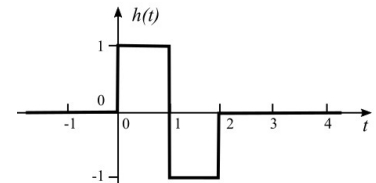
   (E) none of the above.

3. (   ) For the above problem, what is the Laplace transform of the square pulse $x_1(t)$?   (A) $s(1+e^{-s})$,   (B) $s(1-e^{-s})$,
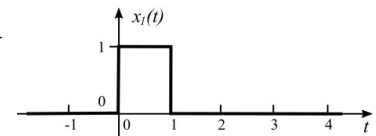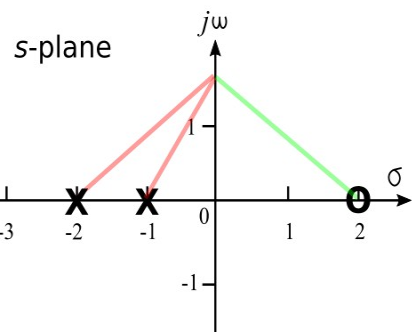
   (C) $\dfrac{1-e^{-s}}{s}$,   (D) $\dfrac{1+e^{-s}}{s}$,   (E) none of the above.

4. (   ) With the same $h(t)$ of the above problem, the input is now a sine wave $x_2(t)=\sin\pi t$. The output $y_2(t) = ?$ (A) $-2\cos\pi t$,   (B) $-\cos\pi t+\sin\pi t$,   (C) $\cos 2\pi t$,   (D) $2\sin\pi t$, (E) none of the above.

5. (   ) The pole-zero plot of a LTI system is shown on the right. Assume that the magnitude of the DC gain is unity. What is the transfer function $H(s)$?   (A) $\dfrac{s+2}{(s-1)(s-2)}$,

   (B) $\dfrac{s-2}{(s+1)(s+2)}$,   (C) $\dfrac{s(s+2)}{(s+1)(s+2)}$,

   (D) $\dfrac{s-2}{(s-1)(s-2)}$,   (E) none of the above.

6. (   ) For the above problem, the red and green lines help to visualize the magnitude of the frequency response. What kind of filter is this?   (A) low-pass, (B) high-pass, (C) band-pass, (D) band-stop, (E) none of the above.

7. (   ) For the above problem, what is the impulse response $h(t)$?   (A) $(3e^{-2t}+7e^{-t})u(t)$,
   (B) $(2e^{-2t}-5e^{-t})u(t)$, (C) $(e^{-2t}+3e^{-t})u(t)$, (D) $(4e^{-2t}-3e^{-t})u(t)$, (E) none of the above.

8. (   ) The transfer function of a LTI system is $H(s)=\dfrac{2}{s^2+2s+5}$, what is its impulse response

h(t)?   (A) $(e^{-2t}\sin t)u(t)$,   (B) $(e^{-2t}\cos t)u(t)$,   (C) $(e^{-t}\sin 2t)u(t)$,

(D) $(e^{-t}\cos 2t)u(t)$,   (E) none of the above.

9. (   )   The factored form of *H(s)* is changed to the partial-fraction form according to:

$\dfrac{s}{(s+3)(s+2)}=\dfrac{a}{s+3}+\dfrac{b}{s+2}$.   a = ?   (A) -2, (B) 2, (C) -3, (D) 3, (E) none of the above.

10. (   ) For the above problem, b = ?   (A) -2, (B) 2, (C) -3, (D) 3, (E) none of the above.