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ECE-205 Quiz 2

1) A **standard form** for a first order system, with input $x(t)$ and output $y(t)$, is

a) $\frac{1}{\tau}\frac{dy(t)}{dt} + y(t) = Kx(t)$ b) $\tau\frac{dy(t)}{dt} + y(t) = Kx(t)$ c) $\frac{dy(t)}{dt} + \tau\, y(t) = Kx(t)$

d) $\frac{dy(t)}{dt} + \tau\, y(t) = \frac{1}{K}x(t)$ e) $\tau\frac{dy(t)}{dt} + y(t) = \frac{1}{K}x(t)$ f) $\frac{dy(t)}{dt} + \tau y(t) = Kx(t)$

2) The units of the time constant, τ, are   a) 1/[time unit]   b) [time unit]   c) neither of these

Problems 3 -5 refer to a system described by the differential equation $2\dot{y}(t) + 2y(t) = 5x(t)$.

3) If the input is a step of amplitude 2, $x(t) = 2u(t)$, then the **steady state value** of the output will be

a) $y(t) = 2.5$ b) $y(t) = 5$ c) $y(t) = 2$ d) none of these

4) The **time constant** of this system is

a) $\tau = 5$ b) $\tau = 2.5$ c) $\tau = 1.0$ d) none of these

5) The **static gain** of this system is

a) $K = 2.5$ b) $K = 2$ c) $K = 5$ d) none of these

6) Assume we have a first order system in standard form, and the input is a step. The usual form used to compute the response of the system is

a) $y(t) = [y(0) - y(\infty)]e^{-t/\tau} + y(0)$ b) $y(t) = [y(\infty) - y(0)]e^{-t/\tau} + y(0)$

c) $y(t) = [y(\infty) - y(0)]e^{-t/\tau} + y(\infty)$ d) $y(t) = [y(0) - y(\infty)]e^{-t/\tau} + y(\infty)$

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7) A **standard form** for a second order system, with input $x(t)$ and output $y(t)$, is

a) $\ddot{y}(t)+\zeta\omega_n\dot{y}(t)+\omega_n^2 y(t)=K\omega_n^2 x(t)$ b) $\ddot{y}(t)+2\zeta\omega_n\dot{y}(t)+\omega_n^2 y(t)=Kx(t)$

c $\ddot{y}(t)+2\zeta\omega_n\dot{y}(t)+\omega_n^2 y(t)=K\omega_n^2 x(t)$ d) $\ddot{y}(t)+2\zeta\omega_n\dot{y}(t)+y(t)=Kx(t)$

Problems 8-11 refer to a system described by the differential equation $2\ddot{y}(t)+\dot{y}(t)+4y(t)=6x(t)$

8) If the input is a step of amplitude 2, $x(t)=2u(t)$, then the **steady state value** of the output will be

a) $y(t)=3$ b) $y(t)=4$ c) $y(t)=6$ d) $y(t)=12$ e) none of these

9) The **natural frequency** of this system is

a) $\omega_n=1$ b) $\omega_n=\frac{1}{\sqrt{2}}$ c) $\omega_n=2$ d) $\omega_n=\sqrt{2}$ e) none of these

10) The **damping ratio** of this system is

a) $\zeta=\frac{\sqrt{2}}{8}$ b) $\zeta=\frac{\sqrt{2}}{4}$ c) $\zeta=\frac{1}{4}$ d) $\zeta=\frac{1}{2\sqrt{2}}$ e) none of these

11) The **static gain** of the system is

a) $K=6$ b) $K=4$ c) $K=1.5$ d) none of these

12) For the differential equation $2\dot{y}(t)+y(t)=\cos(t)x(t)$ with intial time $t_0=2$ and initial value $y(t_0)=2$, the output of the system at time t for an arbitrary input $x(t)$ can be written as

a) $y(t)=2e^{-\frac{t}{2}+1}+\int_2^t e^{-\frac{t}{2}+\frac{\lambda}{2}}\cos(\lambda)x(\lambda)d\lambda$ b) $y(t)=2e^{-\frac{t}{2}+1}+\frac{1}{2}\int_2^t e^{-\frac{t}{2}+\frac{\lambda}{2}}\cos(\lambda)x(\lambda)d\lambda$

c) $y(t)=2e^{-2t+4}+\int_2^t e^{-2t+2\lambda}\cos(\lambda)x(\lambda)d\lambda$ d) none of these

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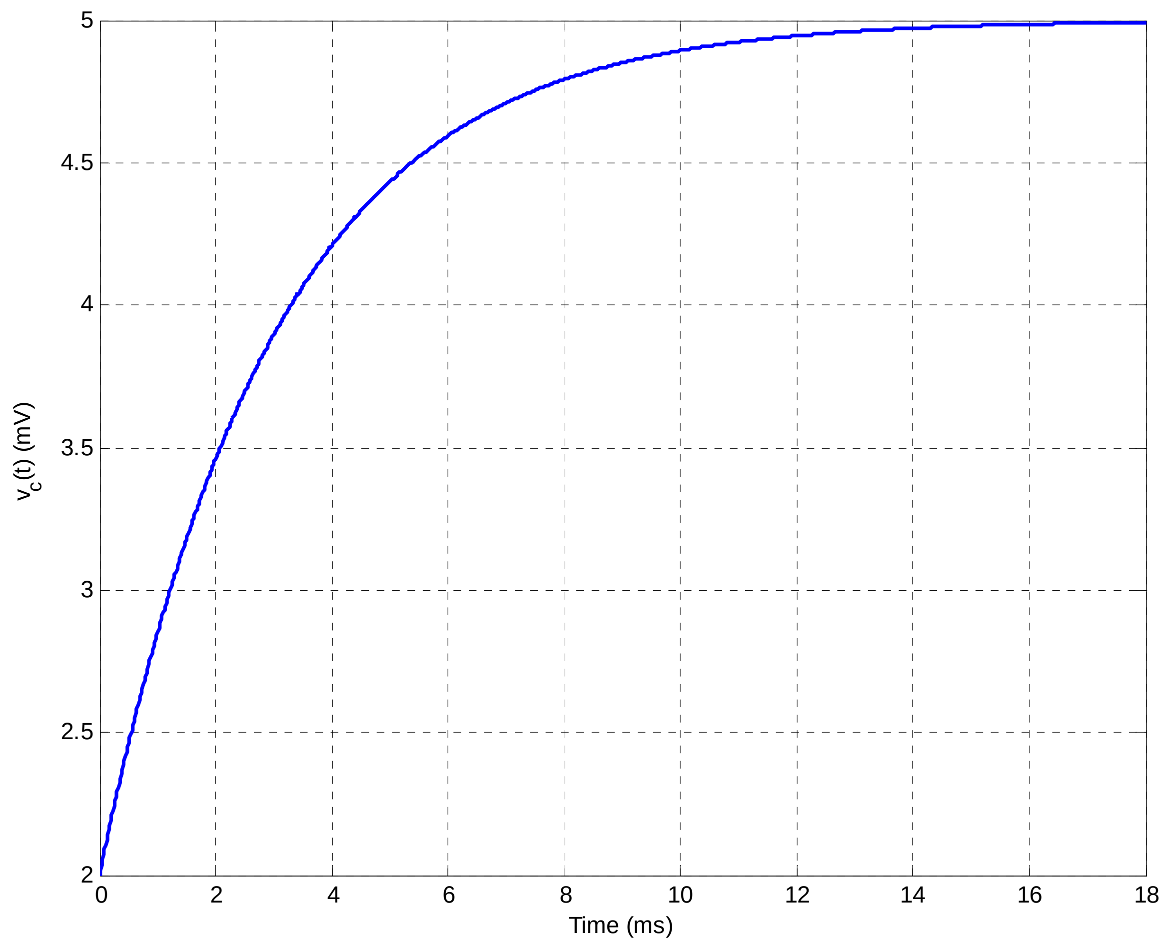
13) For the differential equation $\dot{y}(t) + 2ty(t) = x(t-1)$ with intial time $t_0 = 0$ and initial value $y(t) = 3$, the output of the system at time t for an arbitrary input $x(t)$ can be written as

a) $y(t) = 3 + \int_0^t e^{-t^2+\lambda^2} x(\lambda - 1) d\lambda$ b) $y(t) = 3e^{t^2} + \int_0^t e^{t^2+\lambda^2} x(\lambda - 1) d\lambda$

c) $y(t) = 3e^{-t^2} + \int_0^t e^{-t^2-\lambda^2} x(\lambda - 1) d\lambda$ d) none of these

14) The following figure shows a capacitor charging.



Based on this figure, the best estimate of the **time constant** for this system is

a) 1.5 ms b) 3 ms c) 4.ms d) 12 me e) 16 ms f) 18 ms

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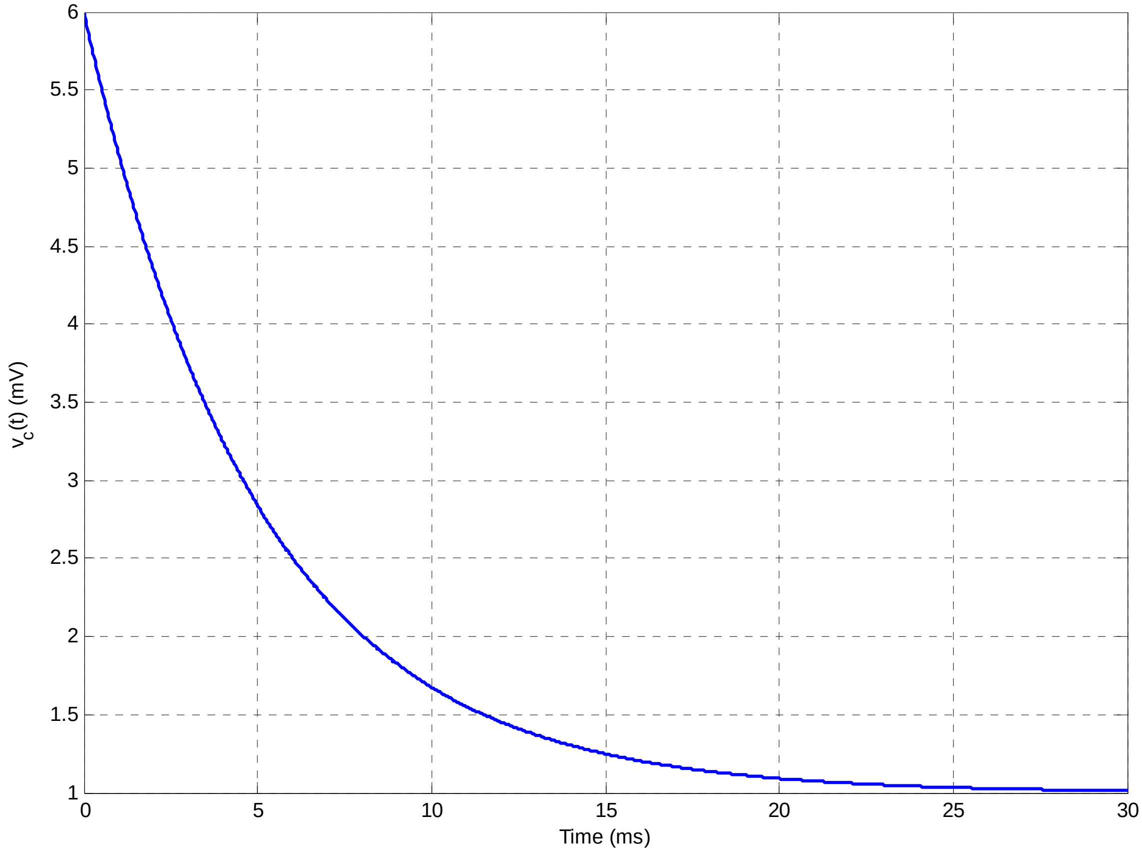
15) The following figure shows a capacitor discharging.



Based on this figure, the best estimate of the **time constant** for this system is

a) 1 ms b) 3 ms c) 5 ms d) 7 me e) 15 ms f) 20 ms