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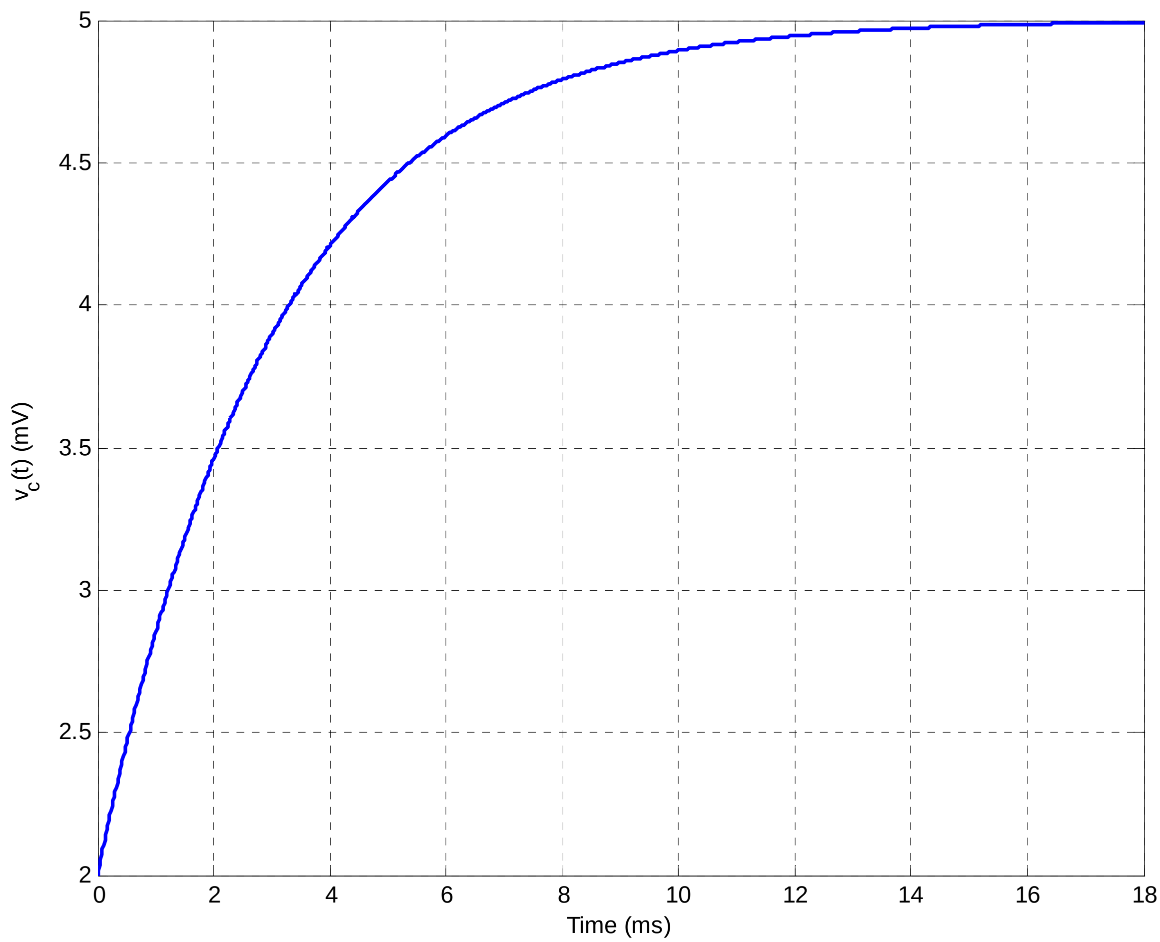
13) For the differential equation $\dot{y}(t) + 2ty(t) = x(t-1)$ with intial time $t_0 = 0$ and initial value $y(t_0) = 3$, the output of the system at time t for an arbitrary input $x(t)$ can be written as

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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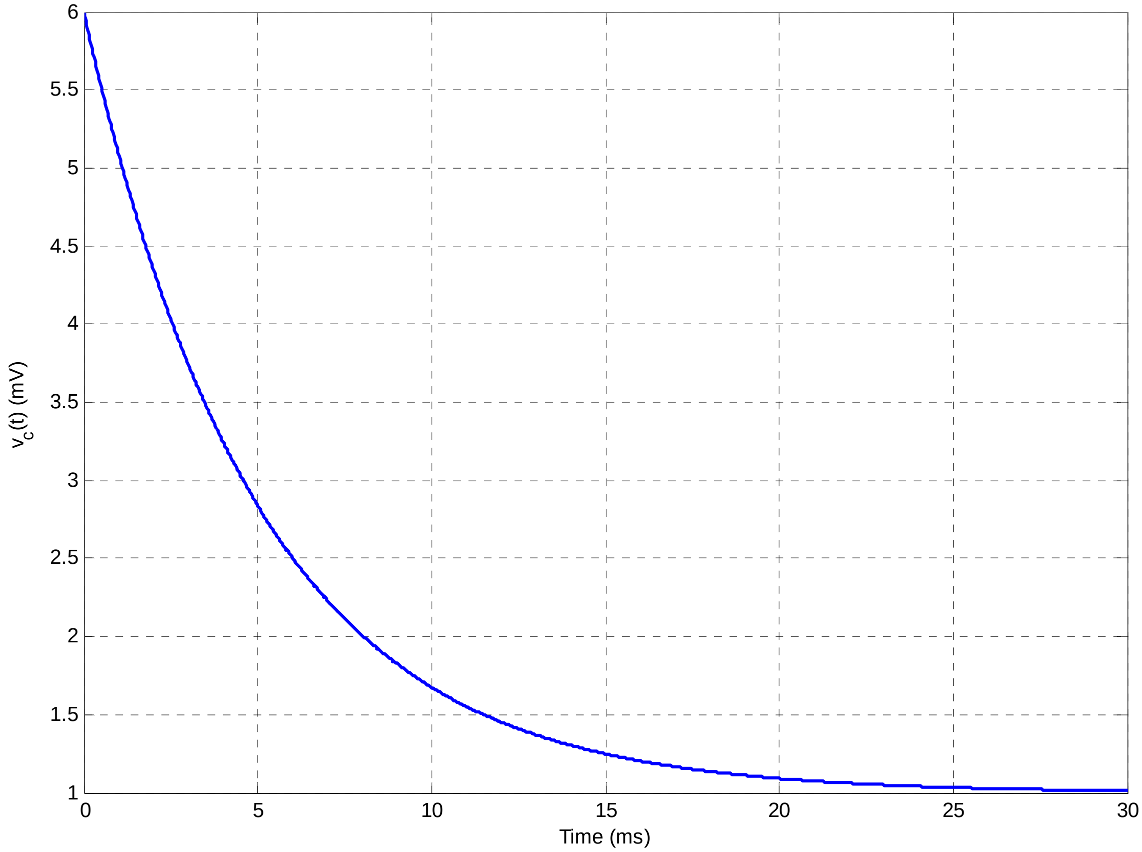
15) The following figure shows a capacitor discharging.



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