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ECE-205 Quiz 2

1) For the second order equation $\ddot{y}(t)+7\dot{y}(t)+12y(t) = 6\,x(t)$ with an input $x(t)=2u(t)$, we should look for a solution of the form

a) $y(t)=c_1e^{-3t}+c_2e^{-4t}+6$ b) $y(t)=c_1e^{-3t}+c_2e^{-4t}+12$ c) $y(t)=c_1e^{-3t}+c_2e^{-4t}+1$

d) $y(t)=c_1e^{3t}+c_2e^{4t}+1$ e) $y(t)=c_1e^{3t}+c_2e^{4t}+6$ f) none of these

2) For the second order equation $\ddot{y}(t)+6\dot{y}(t)+9y(t) = 3\,x(t)$ with an input $x(t)=3u(t)$, we should look for a solution of the form

a) $y(t)=c_1e^{-3t}+c_2te^{-3t}+1$ b) $y(t)=c_1e^{-3t}+c_2e^{-3t}+9$ c) $y(t)=c_1e^{-3t}+c_2te^{-3t}+3$

d) $y(t)=c_1e^{3t}+c_2te^{3t}+1$ e) $y(t)=c_1e^{3t}+c_2te^{3t}+3$ f) none of these

3) For the second order equation $\ddot{y}(t)+4\dot{y}(t)+13y(t) = 26x(t)$ with an input $x(t)=u(t)$, we should look for a solution of the form

a) $y(t)=ce^{-2t}\sin(3t+\theta)+1$ b) $y(t)=ce^{-2t}\sin(3t+\theta)+13$ c) $y(t)=ce^{-3t}\sin(2t+\theta)+2$

d) $y(t)=ce^{-2t}\sin(3t+\theta)+0.5$ e) $y(t)=ce^{2t}\sin(3t+\theta)+13$ f) none of these

4) Assume we have a solution of the form $y(t)=c_1+c_2e^{-3t}+4$ and the initial conditions $y(0)=\dot{y}(0)=0$. The equations we need to solve are:

a) $c_1+c_2=4,\ 2c_2=0$ b) $c_1+c_2=-4,\ -3c_2=0$ c) $c_1+c_2=-4,\ c_1-2c_2=0$

d) $c_1+c_2=-4,\ c_1+3c_2=-4$ e) $c_1+c_2=0,\ c_1+3c_2=-4$ f) none of these

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5) Assume we have a solution of the form $y(t) = c_1 e^{-2t} + c_2 t e^{-2t} + 2$ and the initial conditions $y(0) = \dot{y}(0) = 0$. The equations we need to solve are:

a) $c_1 + 2 = 0,\ -2c_1 + c_2 = 0$ b) $c_1 + 2 = 0,\ 2c_1 + 2\,c_2 = 0$ c) $c_1 + c_2 = -2,\ -2c_1 + -2\,c_2 = 0$

d) $c_1 + c_2 = -2,\ -2c_1 + 2\,c_2 = 0$ e) $c_1 = 2,\ 2c_1 + 2\,c_2 = 0$ f) none of these

6) Assume we have a solution of the form $y(t) = ce^{-t}\sin(2t + \theta) - 4$ and the initial conditions $y(0) = \dot{y}(0) = 0$. The equations we need to solve are:

a) $c\sin(\theta) = -4,\ \tan(\theta) = \frac{3}{2}$ b) $c\sin(\theta) = -4,\ \tan(\theta) = \frac{1}{2}$ c) $c\sin(\theta) = 4,\ \tan(\theta) = \frac{1}{-2}$

d) $c\sin(\theta) = 4,\ \tan(\theta) = 2$ e) $c\sin(\theta) = 4,\ \tan(\theta) = \frac{1}{2}$ f) none of these

7) A first order system has a time constant $\tau = 0.25$ seconds. The system will be within 2% of its final value in (choose the smallest possible time)

a) 0.1 seconds b) 0.2 seconds c) 0.3 seconds d) 0.4 seconds e) 0.5 seconds f) 1 second

8) 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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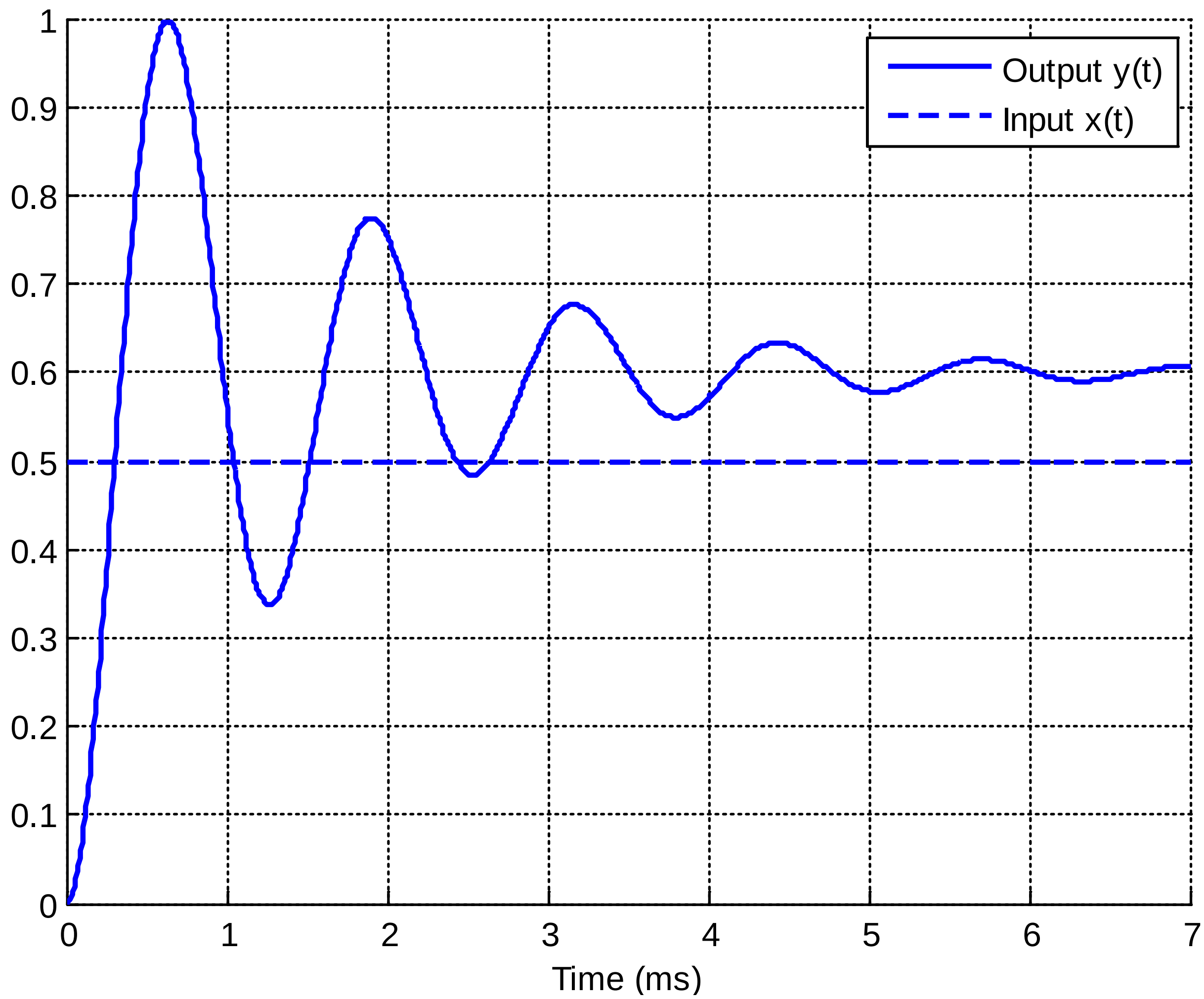
Problems 9 and 10 refer the following graph showing the response of a second order system to a step input.



9) The percent overshoot for this system is best estimated as

a) 200 % b) 150 % c) 100% d) 67 % e) 50 % f) 33%

10) The static gain for this system is best estimated as

a) 0.1 b) 0.5 c) 1.0 d) 1.2 e) 1.5 f) 2.0

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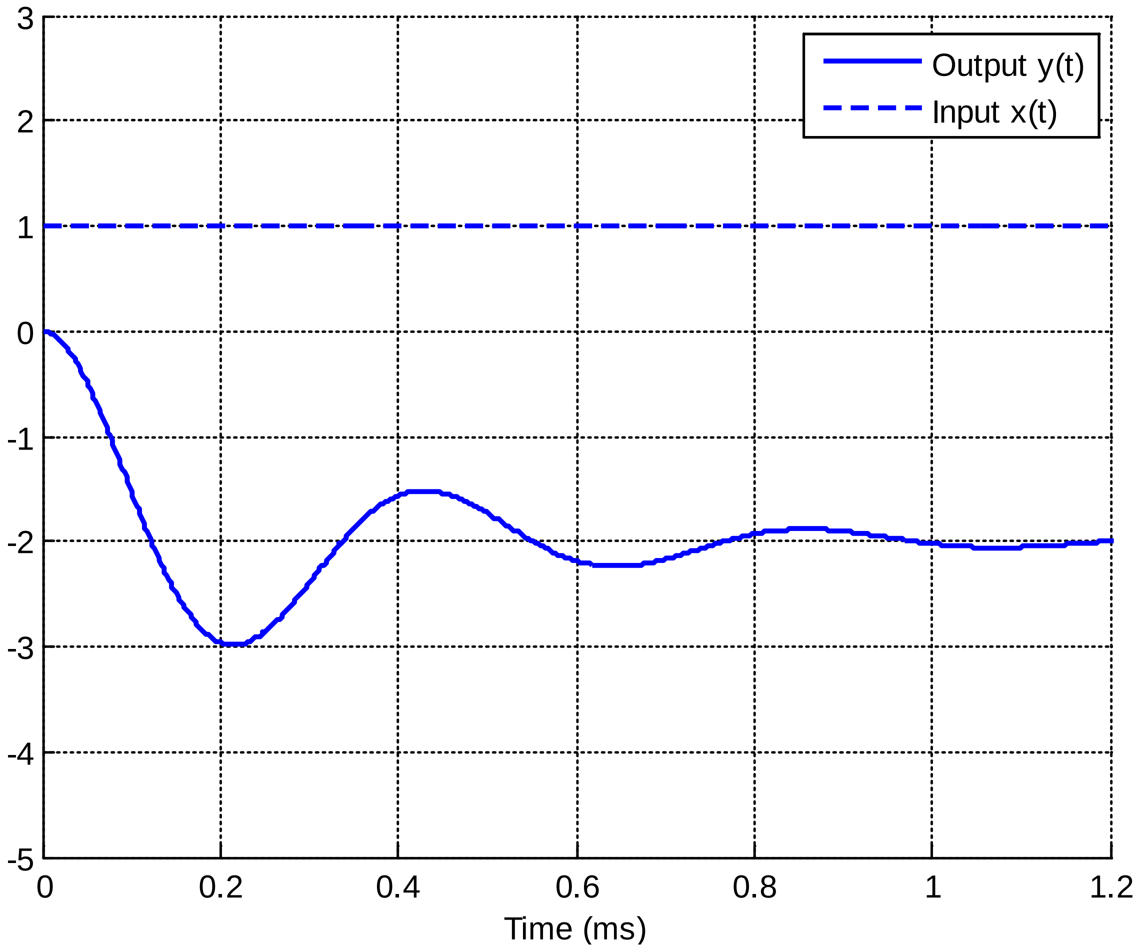
Problems 11 and 12 refer the following graph showing the response of a second order system to a step input.



11) The percent overshoot for this system is best estimated as

a) 200% b) -200 % c) 100% d) -100 % e) 50 % f) -50%

12) The static gain for this system is best estimated as

a) 3 b) -3 c) 2 d) -2

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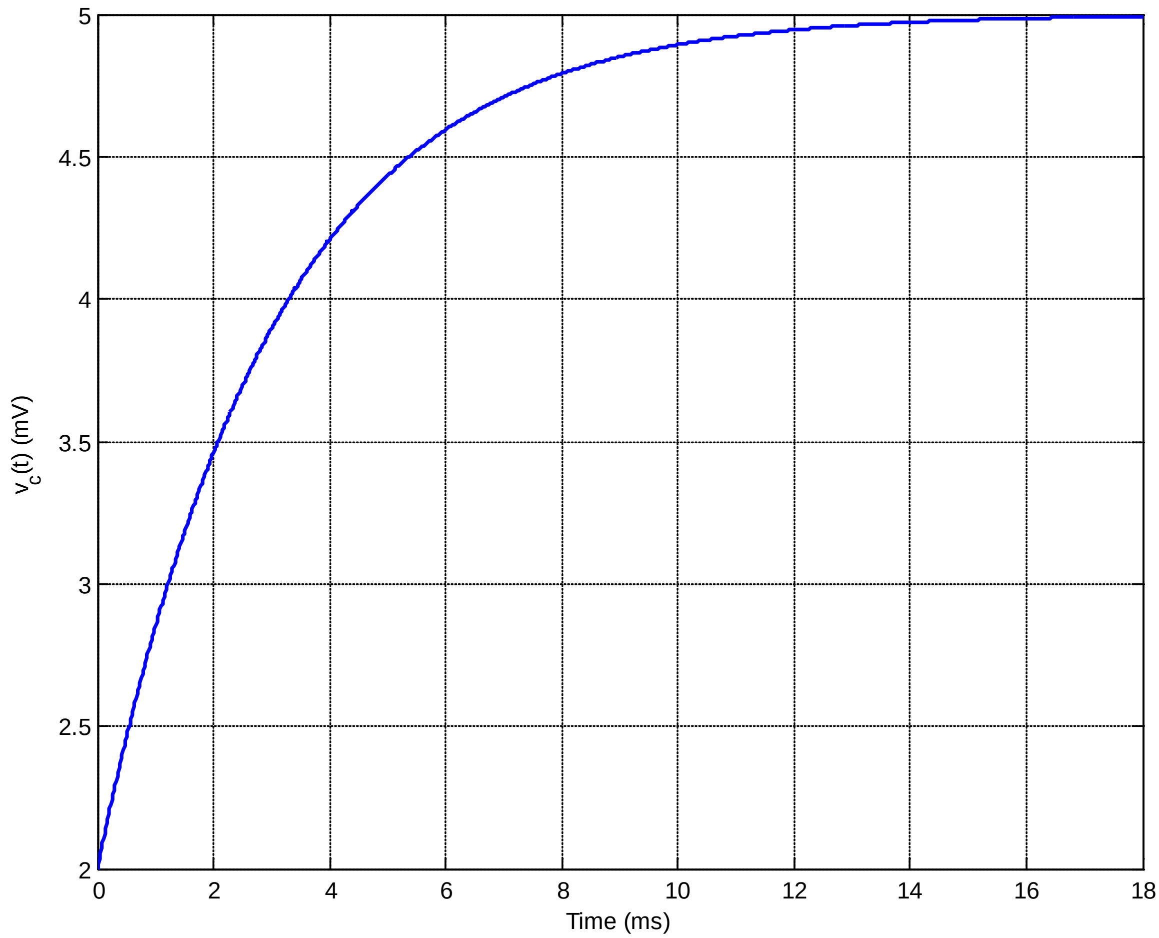
13) The following figure shows a capacitor charging.



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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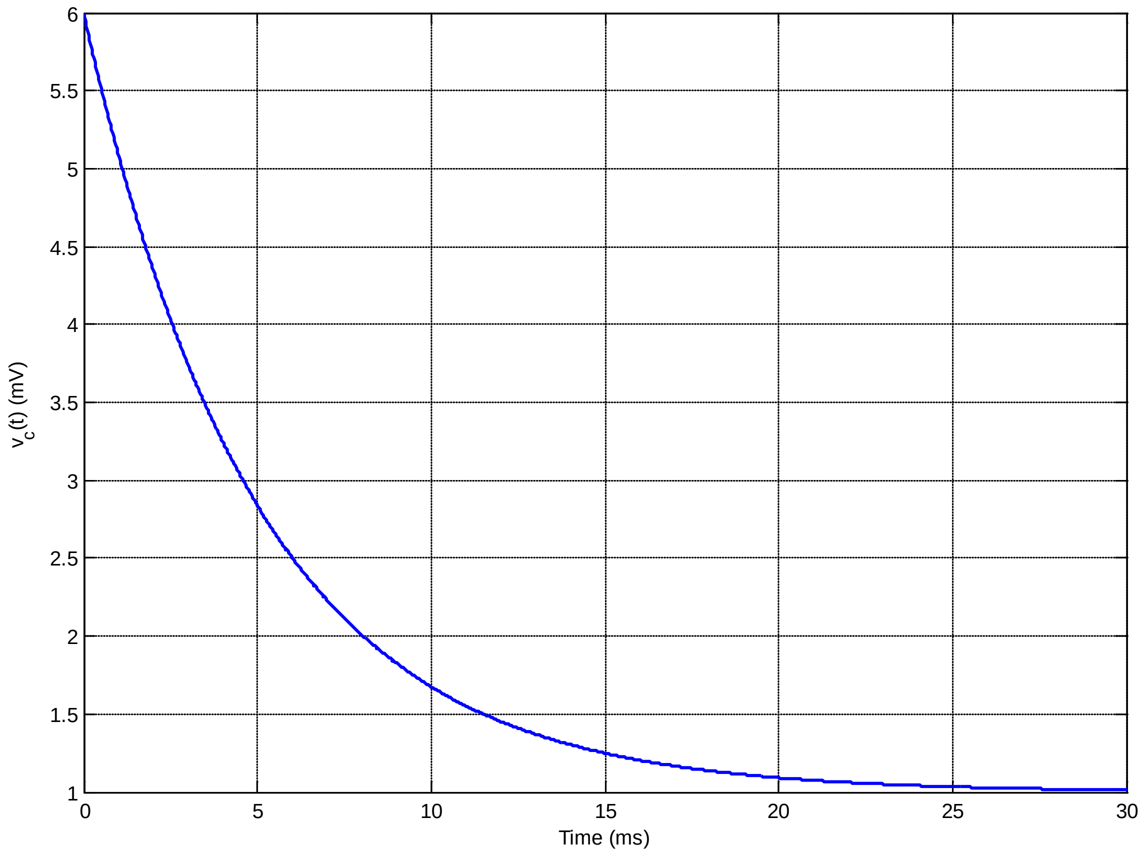
14) The following figure shows a capacitor discharging.



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 ms e) 15 ms f) 20 ms

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15) Assume we are trying to use measure the time constant of a first order system experimentally using the rise time of the system. The input to the system is the rectangular pulse shown in the dotted line. Which of the experiments can we use? (Circle all that can be used)

a) Experiment 1 b) Experiment 2 c) Experiment 3 d) Experiment 4