University of Jordan
Department of Electrical Engineering
Control Systems (EE 4411)

First Exam | 20 Marks | 2/11/2010

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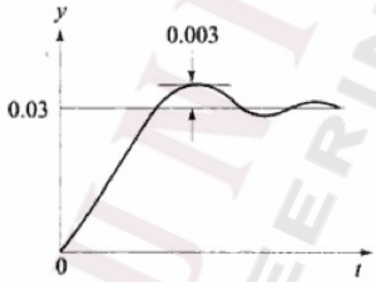
Please write your name in arabic

Question 1: The step response of a second order system is shown below. The value of the damping ratio of the system is



A: none of these B: 0.88 C: 0.49 D: 0.39 E: 0.59

Question 2: Consider the function $f(t)$ having Laplace transform $F(s) = \dfrac{\omega_0}{s^2+\omega_0^2}$. The final value of $f(t)$ would be

A: infinity B: -1 C: 1 D: none of these E: 0

Question 3: The open loop transfer function of a unity feedback system is $G(s) = \dfrac{50}{\tau s + 10}$. The sensitivity of the closed loop system to small changes in τ is

A: $\dfrac{-\tau s}{\tau s + 60}$ B: $\dfrac{\tau}{\tau s + 10}$ C: $\dfrac{\tau}{\tau s + 60}$ D: $\dfrac{-\tau s}{\tau s + 10}$ E: need more information

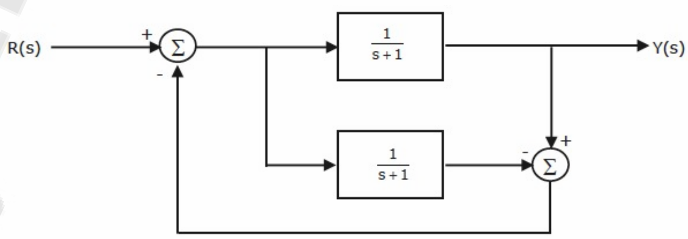
Question 4: If the characteristic polynomial of a closed loop system is $s^2 - 2s + 1 = 0$, then the system is

A: critically damped B: underdamped C: undamped D: none of these E: overdamped

Question 5: A unity feedback system has open loop transfer function $G(s) = \dfrac{25}{s(s+6)}$. The time T_p at which the peak of the step-input response occurs, is

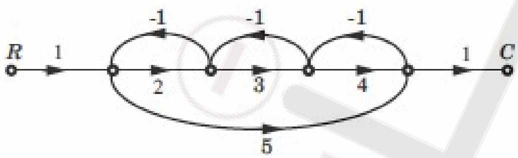
A: 11/7 sec B: 11/28 sec C: 11/14 sec D: there is no overshoot E: 11/4 sec

Question 6: The transfer function between $Y(s)$ and $R(s)$ of the system shown is



A: $\dfrac{1}{s+1}$ B: none of these C: $\dfrac{2}{s+3}$ D: $\dfrac{2}{s+1}$ E: zero

Question 7: In a signal flow graph shown below the gain C/R is

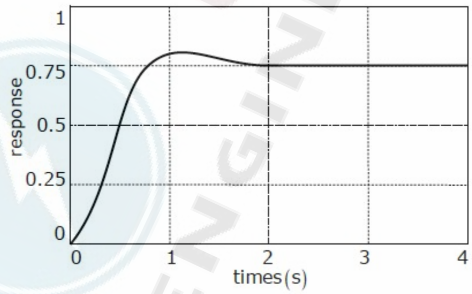


A: $\frac{29}{19}$ B: $\frac{44}{23}$ C: none of these D: $\frac{29}{11}$ E: $\frac{44}{19}$

Question 8: If $\mathcal{L}[f(t)] = \frac{2(s+1)}{s^2+2s+5}$, then $f(0^+)$ and $f(\infty)$ are given by

A: none of these B: $\frac{2}{5}$,0 respectively C: 0,2 respectively D: 0,1 respectively E: 2,0 respectively

Question 9: The unit-step response of a unity feedback system with open loop transfer function $G(s) = \frac{K}{(s+1)(s+2)}$ is shown in the figure below. The value of K is



A: 2 B: 0.5 C: 6 D: 4 E: 3

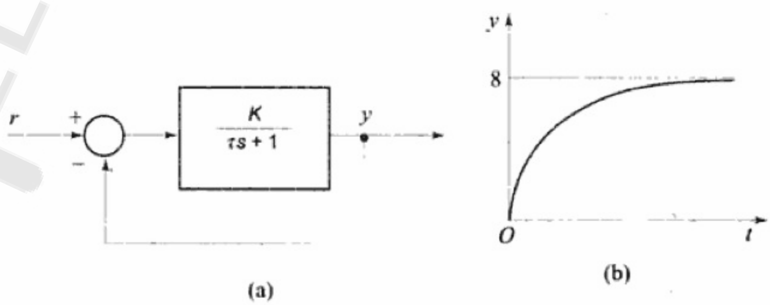
Question 10: A control system has the closed loop transfer function given by $T(s) = \frac{K}{(s+45)^2+K}$. Determine the value of the gain K so that the closed loop system has a damping ratio $\zeta = \frac{\sqrt{2}}{2}$.

A: $K = 2025$ B: $K = 25$ C: none of these D: $K = 1025$ E: $K = 10500$

Question 11: The open loop dc gain of a unity negative feedback system with closed loop transfer function $\frac{s+4}{s^2+7s+13}$ is

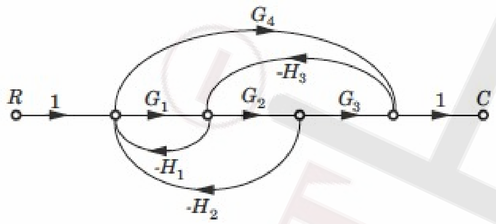
A: none of these B: $\frac{4}{13}$ C: $\frac{4}{9}$ D: 4 E: 13

Question 12: The time response of the system shown below in (a) to an input $r(t) = 10$, $t > 0$ is shown in (b). The gain K is equal to



A: 4 B: 2 C: none of these D: 8 E: 10

Question 13: Consider the signal flow graph shown below. The Δ for this graph is



A: $1 - G_1H_1 - G_1G_2H_2 - G_2G_3H_3 + G_4H_1H_3$
B: $1 + G_1H_1 + G_1G_2H_2 + G_2G_3H_3$
C: $1 + G_1H_1 + G_1G_2H_2 + G_2G_3H_3 - G_4H_1H_3$
D: $1 - G_1H_1 - G_1G_2H_2 - G_2G_3H_3$
E: none of these

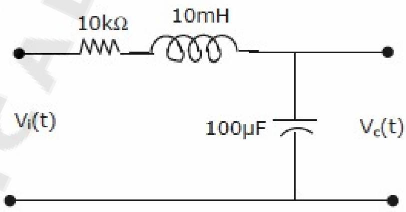
Question 14: A linear time-invariant system initially at rest, when subjected to a unit-step input, gives a response $y(t) = te^{-t}$; $t > 0$. The transfer function of the system is

A: $\dfrac{s}{(s+1)^2}$ B: $\dfrac{1}{(s+1)^2}$ C: $\dfrac{1}{s(s+1)}$ D: none of these E: $\dfrac{1}{s(s+1)^2}$

Question 15: A system described by the differential equation $\dfrac{d^2y}{dt^2} + 3\dfrac{dy}{dt} + 2y = x(t)$ is initially at rest. For input $x(t) = 2$; $t > 0$, the output $y(t)$ for $t > 0$ is

A: none of these B: $0.5 + 2e^{-t} + 2e^{-2t}$ C: $1 + 2e^{-t} - e^{-2t}$ D: $1 - 2e^{-t} + e^{-2t}$ E: $0.5 + e^{-t} + 1.5e^{-2t}$

Question 16: For the circuit shown in the figure below, the initial conditions are zero. Its transfer function $H(s) = \dfrac{V_c(s)}{V_i(s)}$ is



A: $\dfrac{1}{s^2 + 10^6 s + 10^6}$ B: $\dfrac{10^6}{s^2 + 10^3 s + 10^6}$ C: $\dfrac{10^3}{s^2 + 10^3 s + 10^6}$ D: none of these E: $\dfrac{10^6}{s^2 + 10^6 s + 10^6}$

Question 17: A second order system with no zeros has its poles located at $-3 + j4$ and $-3 - j4$ in the s-plane. The undamped natural frequency and the damping ratio of the system are respectively

A: none of these B: 3 rad/s and 0.6 C: 5 rad/s and 0.6 D: 5 rad/s and 0.8 E: 3 rad/s and 0.8

Question 18: For a second order system with the closed-loop transfer function $T(s) = \dfrac{9}{s^2 + 4s + 9}$. The settling time for a 2% band, in seconds is

A: 4 B: 2 C: 3 D: none of these E: 1.5

Question 19: Poles with the same time to the first peak lie in the s-plane

A: on the same horizontal line B: on the same radial line from the origin C: on the same distance from the origin D: on the same vertical line E: none of these

Question 20: The unit impulse response of a unity feedback system is given by $h(t) = 2e^{-t} - te^{-t}$, $t \geq 0$. The open loop transfer function is equal to

A: $\dfrac{s+1}{(s+2)^2}$ B: $\dfrac{2s+1}{s^2}$ C: $\dfrac{s+1}{s^2}$ D: $\dfrac{2s+1}{(s+1)^2}$ E: none of these