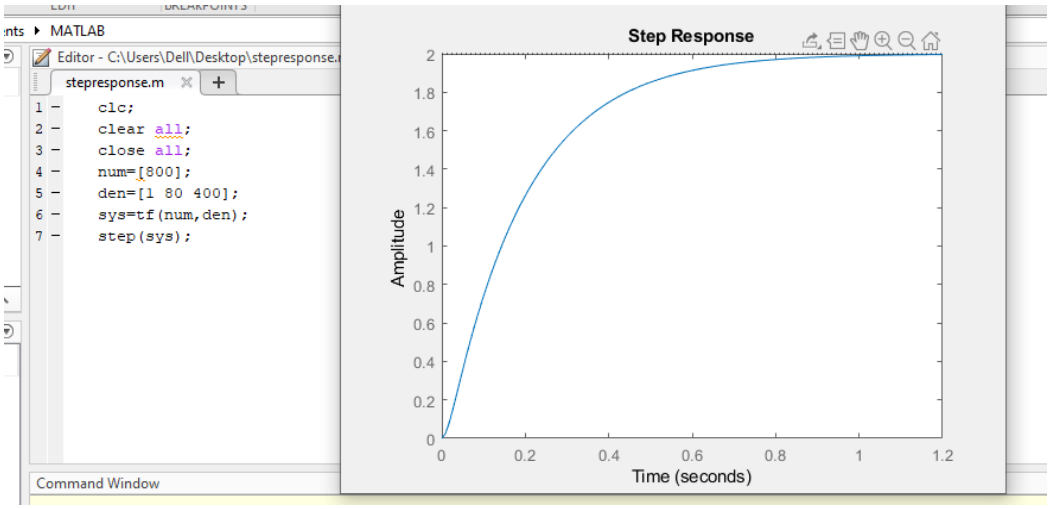
**Perla Vanessa Jaime Gaytán**

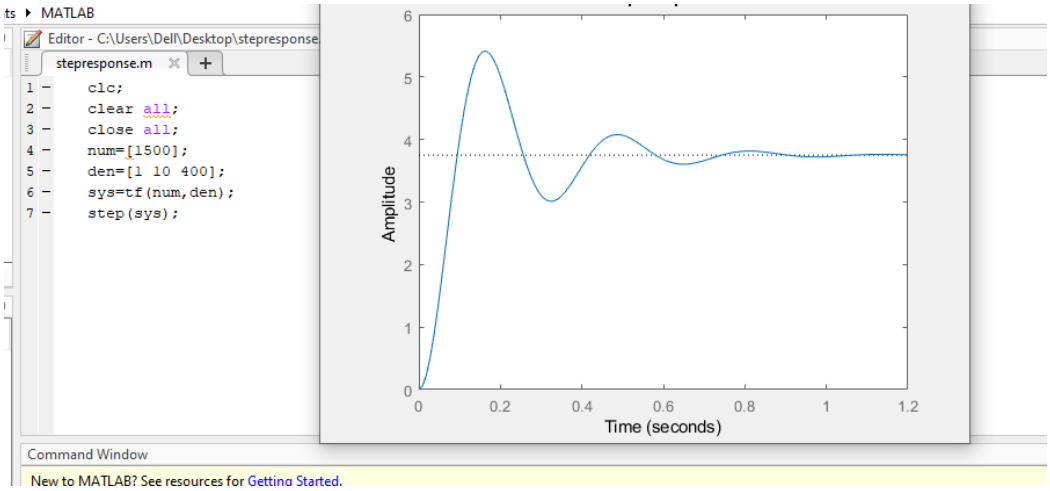
**A0034442**

# 1st Partial Exam

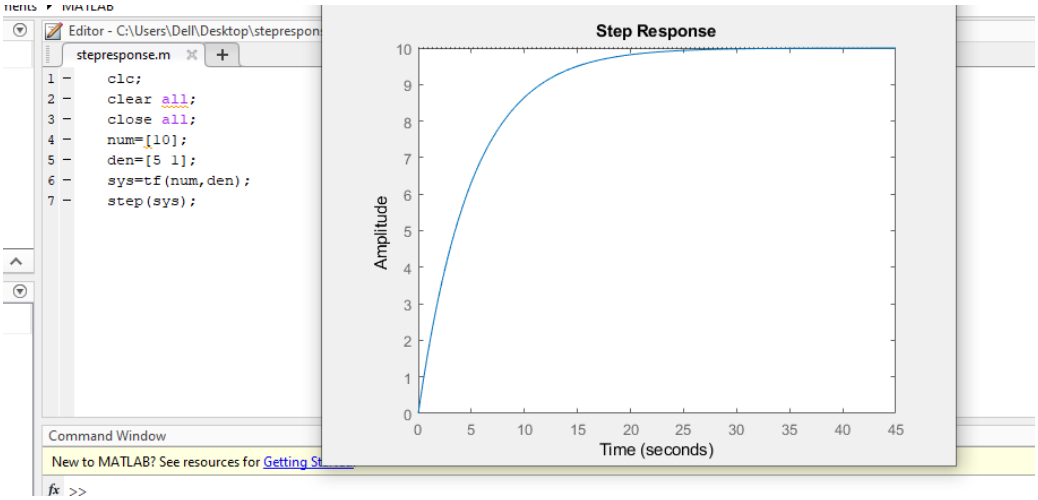
1.




2.




16.


Editor - C:\Users\Dell\Desktop\stepespon
stepresponse.m
1 clc;
2 clear all;
3 close all;
4 num=[10];
5 den=[5 1];
6 sys=tf(num,den);
7 step(sys);
Command Window
New to MATLAB? See resources for Getting St
>>
Step Response
Amplitude
Time (seconds)
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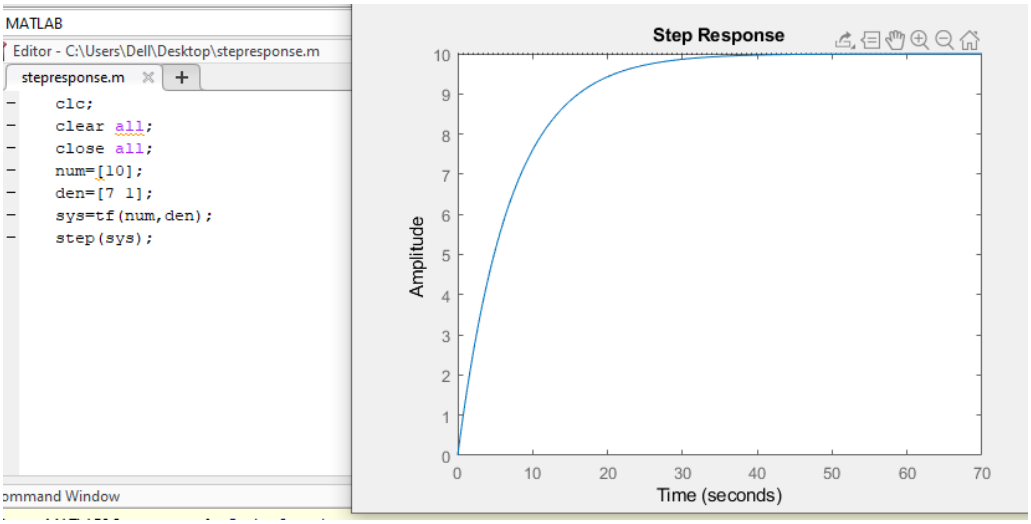
40
45

17.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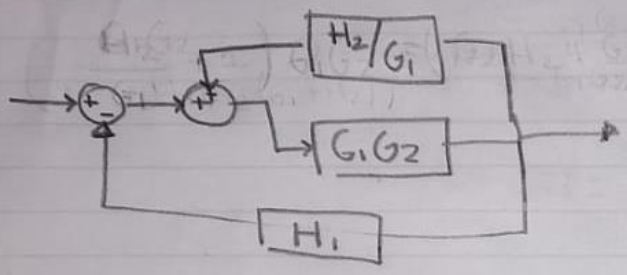
Revla Vanessa Jaime

# 1st Partial Exam

① matlab

② matlab

③




$$= \frac{G_1G_2}{1 - G_2H_2 + G_1G_2H_1}$$

④ Natural frequency $u(t)=2$

$$G(s) = \frac{14}{4s^2+6s+117}$$

$$\omega_n = \sqrt{\frac{117}{4}} = 5.408$$

⑤ $G(s) = \frac{249}{4s^2+7s+247}$ $\quad y_{ss} = ? \quad u(t)=3$

$$y_{ss} = \lim_{s\to 0} G(s)u(t) = \left(\frac{249}{247}\right)3 = 3.024$$

⑥ $G(s) = \frac{2}{11s+31}$ $t_{ss} = ?$ 99.33%

$G(s) = \frac{K_s}{T_s+1} = \frac{2/31}{\frac{11}{31}s+31}$

$t_{ss} = 5\left(\frac{11}{31}\right) = \underline{1.774}$ //

⑦ $G(s) = \frac{17}{2s^2+5s+244}$ $u(t) = 2$ $\delta = ?$

$\omega_n = \sqrt{\frac{K}{m}} = \sqrt{\frac{244}{2}} = \sqrt{122}$

$2(m)\delta\omega_n = c$ $\delta = \frac{5}{4\sqrt{122}} = \underline{0.113}$ //

$2(2)\delta(\sqrt{122}) = 5$

⑧ $y_{ss} = ?$ $u(t) = 3\frac{7}{s}$

$G(s) = \frac{14}{10s+5}$

$y_{ss} = \lim_{s\to 0} u(t)\,G(s) = 3\left(\frac{14}{5}\right) = \underline{8.4}$ //

⑨ $\omega_d = ?$ $u(t) = 2$ $G(s) = \frac{10}{2s^2+6s+322}$

$\omega_n = \sqrt{\frac{322}{2}} = \underline{\sqrt{161}}$ //

$2 \cdot 2 \cdot \delta \cdot \sqrt{161} = 6$

$\delta = \frac{6}{4\sqrt{161}} = \underline{\frac{3\sqrt{161}}{322}}$

$\omega_d = \omega_n\sqrt{1-\delta^2}$

$\omega_d = \sqrt{161}\sqrt{1-\left(\frac{3\sqrt{161}}{322}\right)^2}$

$\omega_d = \underline{12.599}$ //

(10) $G(s) = \frac{7}{7s+26}$

$K = ?$ $K > 0$ $e_{ss} = 9\%$

$e_{ss} = \pm 0.09$

$e_{ss} = \frac{1}{1+K_p}$ $K_p = \frac{1}{e_{ss}} - 1$ → +: 10.111, −: −12.111

$K_p = \lim_{s \to 0} KG(s) = K\left(\frac{7}{26}\right)$ $K > 0$ ∴ $K_p = + = 10.111$

$10.111 = K\left(\frac{7}{26}\right)$ $K = \frac{10.111(26)}{7} = 37.555$ //

(11) $G(s) = \frac{20}{3s^2+8s-32}$ $K = ?$ $K > 0$ $e_{ss} = 4\%$

$e_{ss} = \pm 0.04$ $e_{ss} = \frac{1}{1+K_p}$ $K_p = \frac{1}{e_{ss}} - 1$ → 24, −26

$K_p = \lim_{s \to 0} KG(s) = K\left(\frac{20}{-32}\right)$ $K > 0$ ∴ $K_p = (-) = -26$

$-26 = K\left(\frac{20}{-32}\right)$ $K = \frac{26(32)}{20} = 41.600$

(12) $G(s) = \frac{17}{3s^2+7s+4}$ $3s^2+7s+4 = 0$

$\lambda_1 = -1.333$ $\lambda_2 = -1$ → stable

(13) $G(s) = \frac{1}{s^2+9s-7}$ $K = 3$

$\frac{1(K)}{s^2+9s-7+1(K)} = \frac{3}{s^2+9s-7+3} = \frac{3}{s^2+9s-4}$

$s^2+9s-4 = 0$ $\lambda_1 = -9.424$ $\lambda_2 = 0.424$ → (+) ∴ unstable

(14) $G(s) = \frac{3}{23s-5}$ $K=2$

$$\frac{3K}{23s-5+3K} = \frac{6}{23s-5+6} = \frac{6}{23s+1}$$

$23s+1=0$

$s=-1/23$ // → stable

(15) $G(s) = \frac{14}{15s+6}$

$15s+6=0$

$s=-6/15$ → stable

(16) matlab

(17) matlab

(18) $G(s) = \frac{362}{s^2+6s+43}$ settling time = ?

$K=26$ 2%

$\frac{362K}{s^2+6s+43+362K}$ $\omega_n = \sqrt{43+362K} = \sqrt{9455}$ //

$2 \cdot 1 \cdot \delta \cdot \omega_n = 6$ $\delta = 3/\omega_n$ // $t_{ss} = \frac{4}{\delta \omega_n} = \frac{4}{\frac{3}{\omega_n} \cdot \omega_n} = \frac{4}{3}$

$t_{ss} = 1.333$ //

(19) $G(s) = \frac{19}{6s+18}$ output $\quad K=55 \quad r(t)=3$

$$\lim_{s\to 0} r(t)\frac{19K}{6s+18+19K} = 3\left(\frac{57}{75}\right) = 2.28 //$$

(20) $G(s) = \frac{219}{5s^2+46s+347}$ output $\quad K=16 \quad r(t)=3$

$$\lim_{s\to 0} r(t)\left(\frac{219K}{5s^2+46s+347+219K}\right) = 3\left(\frac{3504}{3851}\right) = 2.729 //$$

(21) $G(s) = \frac{3}{186s+2}$ setting time $\quad K=12 \quad 99.33\%$

$$\frac{3K}{186s+2+3K} = \frac{36}{186s+38} \qquad T = \frac{186}{38} - \frac{93}{19}$$

$$t_{ss} = 5T = 24.474 //$$

(22) $4\ddot{y}(t) + 5\dot{y}(t) + 6y(t) = 2\dot{u}(t) + 3u(t)$

$$4s^2Y(s) + 5sY(s) + 6Y(s) = 2sU(s) + 3U(s)$$
$$Y(s)(4s^2+5s+6) = U(s)(2s+3)$$
$$\frac{Y(s)}{U(s)} = \frac{2s+3}{4s^2+5s+6}$$

(23) $2\ddot{y}(t) + 3\dot{y}(t) + 4y(t) = 5\dot{u}(t) + 6u(t)$

$2s^2 Y(s) + 3sY(s) + 4Y(s) = 5sU(s) + 6U(s)$

$Y(s)[2s^2 + 3s + 4] = U(s)[5s + 6)$

$$\frac{Y(s)}{U(s)} = \frac{5s+6}{2s^2+3s+4} \;//$$

(24)

$f(t) = a\,u_1(t) - 2a\,u_3(t) + \frac{2}{3}a\,(u_5(t) - u_8(t)) + 0.5a\,u_{10}(t)$

$(8, a)\ (5, -a)$

$m = \frac{-a-a}{5-8} = \frac{-2a}{-3} = \frac{2}{3}a$

$$\mathcal{L}\{f(t)\} = \frac{a e^{-s}}{s} - \frac{2a e^{-3s}}{s} + \frac{2}{3s}a\left(\frac{e^{-5s}}{s}\right) - \frac{2}{3s}a\left(\frac{e^{-8s}}{s}\right) + \frac{a e^{-10s}}{2}$$