Midterm exam Control I communication & control groups

A) Calculate the zeroes and poles of the following systems and then draw them in the S-
ne:

[2 marks]

$$G1(S) = \frac{(S^2 - 16)}{(2S^2 + 14S + 6)} \qquad G2(S) = \frac{(2S + 2)}{(S^2 + 25)}$$

ind the Laplace transform for the following functions: [2 marks]

$$f(t) = 3\cos 4t + 5t^3 + e^{3t}\sin 2t + 2t^3 e^{-4t}$$

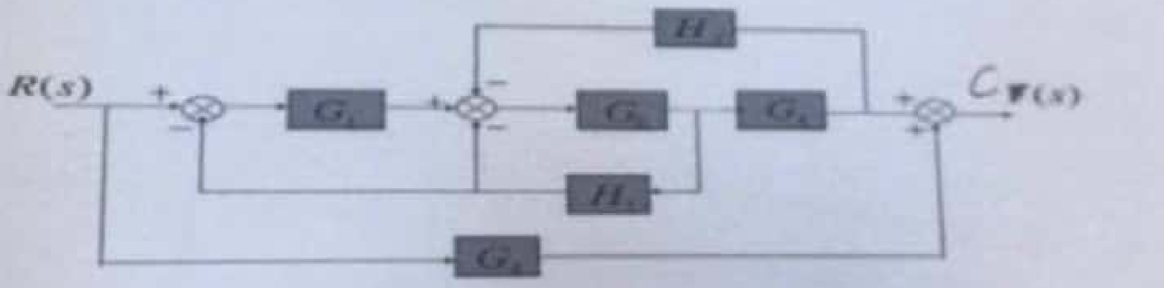
or the following system, find the inverse Laplace [5 marks]

$$G(S) = \frac{3S + 1}{S(S^2 + 6S + 9)}$$

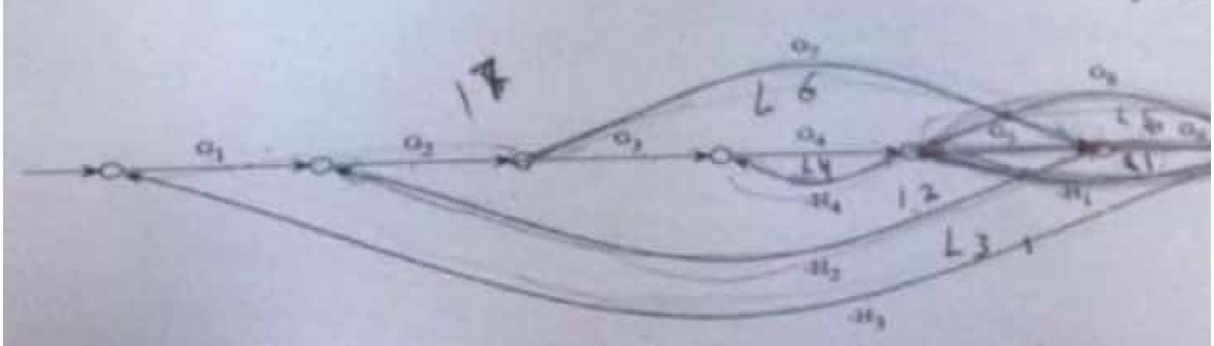
onsider the differential equation, where the initial condition are y(0)= -1 and $y^1(0)$=
nine Y(s). [4 marks]

$$\frac{d^2y(t)}{dt^2} - 10\frac{dy(t)}{dt} + 9\,y(t) = 5t$$

sing Block diagram reduction rules, determine the close loop transfer function (C/R)
[7 marks]



tain the overall transfer function for the following signal flow graph using Mason
[8 ma



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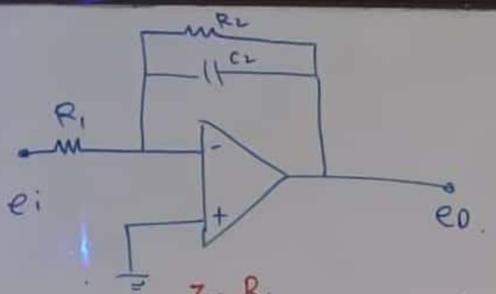


$$Z_1 = R_1$$

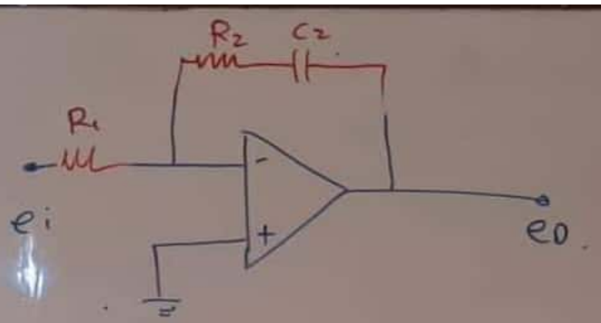
$$Z_2 = R_2 // C_2 = \frac{R_2 \cdot \frac{1}{CS}}{R_2 + \frac{1}{CS}}$$

$$T.F = -\frac{Z_2}{Z_1} = -\frac{\frac{R_2/CS}{R_2 + \frac{1}{CS}}}{R_1}$$

$$T.F = -\frac{R_2/CS}{R_1 R_2 + \frac{R_1}{CS}}$$

$$= -\frac{R_2}{R_1 R_2 CS + R_1}$$

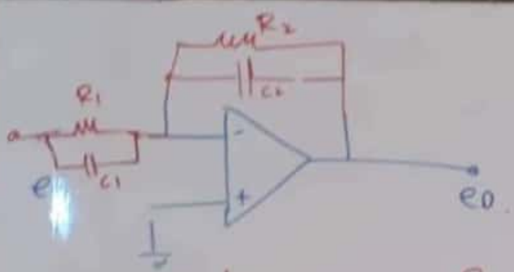
$$= -\frac{R_2}{R_1} * \frac{1}{R_2 CS + 1}$$



$$Z_1 = R_1$$

$$Z_2 = R_2 + \frac{1}{C_2 S}$$

$$T.F = -\frac{Z_2}{Z_1} = \frac{R_2 + \frac{1}{C_2 S}}{R_1} = \frac{R_2 C_2 S + 1}{R_1 C_2 S}$$



$$Z_2 = \frac{R_2 \cdot \frac{1}{C_2 S}}{R_2 + \frac{1}{C_2 S}} = \frac{R_2}{R_2 C_2 S + 1}$$

$$Z_1 = \frac{R_1 \cdot \frac{1}{C_1 S}}{R_1 + \frac{1}{C_1 S}} = \frac{R_1}{R_1 C_1 S + 1}$$

$$T.F = - \frac{R_2 / R_2 C_2 S + 1}{R_1 / R_1 C_1 S + 1}$$

$$T.F = - \frac{R_2 R_1 C_1 S + R_2}{R_1 R_2 C_2 S + R_1}$$

$$=$$

College of Electronic Technology

Final Exam — Control [illegible] — Time: 2 hours — Date: [illegible]

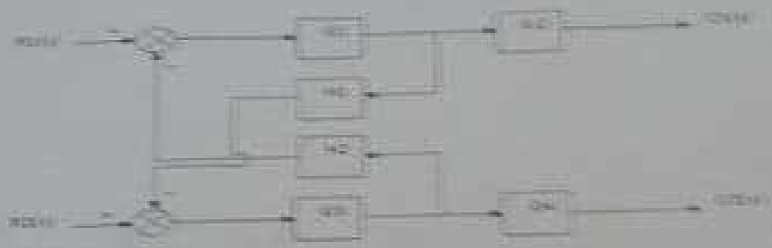
Q1-A) Calculate the zeroes and poles of the following systems and then draw them in the S-plane. [? marks]

$$y(s) = \frac{(S^2-16)}{(2S^2+6S+8)} \qquad z(s) = \frac{(2S+7)}{(S^2+2S)}$$

Q1-B) Consider the differential equation, where the initial conditions are y(0) = −2 and y'(0) = −1, determine Y(s). [? marks]

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6y(t) = 7u(t)$$

Q2: Using the rules of the block diagram reduction. Find the overall transfer functions $\frac{C_1(s)}{R_1(s)}$ and $\frac{C_2(s)}{R_2(s)}$ of the given closed loop control system. [7 marks]



Q3: A) A step response for a first order system is shown below. Find the transfer function of the system in standard form, if the input signal is 2u(t). [5 marks]

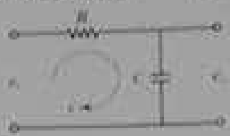
Q3: B) Consider the following electrical Circuit shown in the figure: [10 marks]

a) Obtain the transfer function E_o/E_i

b) Find c(t) when the input signal is (2/s).

c) Determine the final Value.

d) Draw the transient response.



Where: $R = 2 * 10^{6}$, $C = 1 * 10^{-6}$

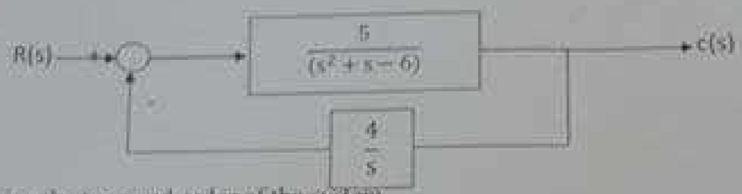
Q4: For the following 2^{nd} order control system: $\frac{C(S)}{R(S)} = \frac{1}{S^2+5S+25}$ [10 marks]

a) Determine values of ζ, W_n, W_d.

b) Find c(t), when the input signal is $\frac{2}{s}$.

c) Determine values of M_p, t_p, t_s, t_r

Q5:A)

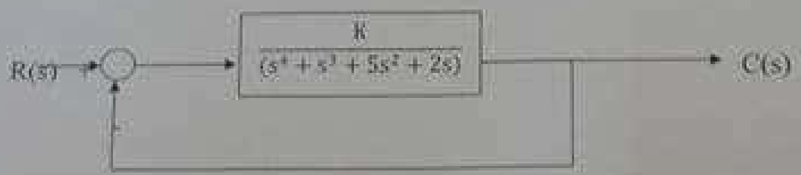


a)Determine the type and order of the system

b)Determine the static error constant (k_p, k_v, k_a). [5 marks]

c) Then, find steady state error e_{ss} for step, ramp and acceleration inputs.

Q5:B)



Using Routh criterion determine the range of the gain K for a stable system. [5 marks]

Good Luck

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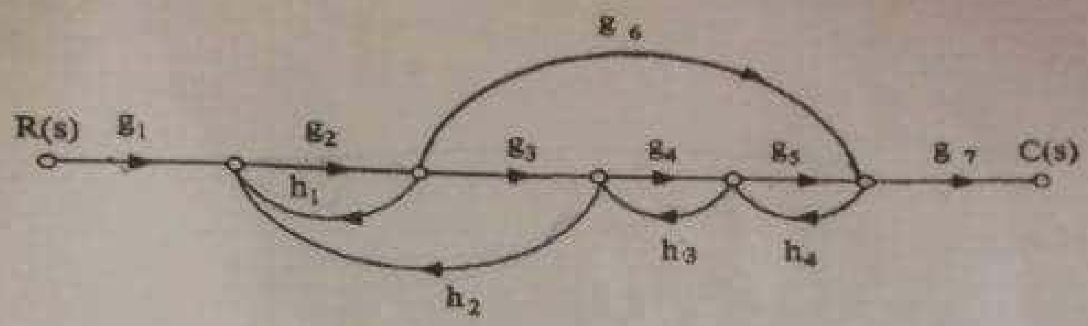
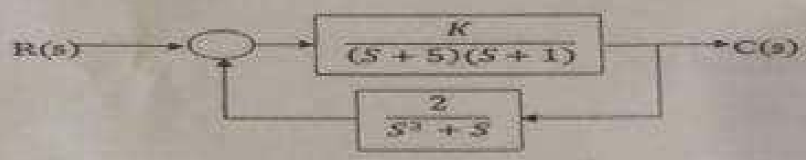
Q3: Obtain the overall transfer function for the following signal flow graph using Mason's rule:

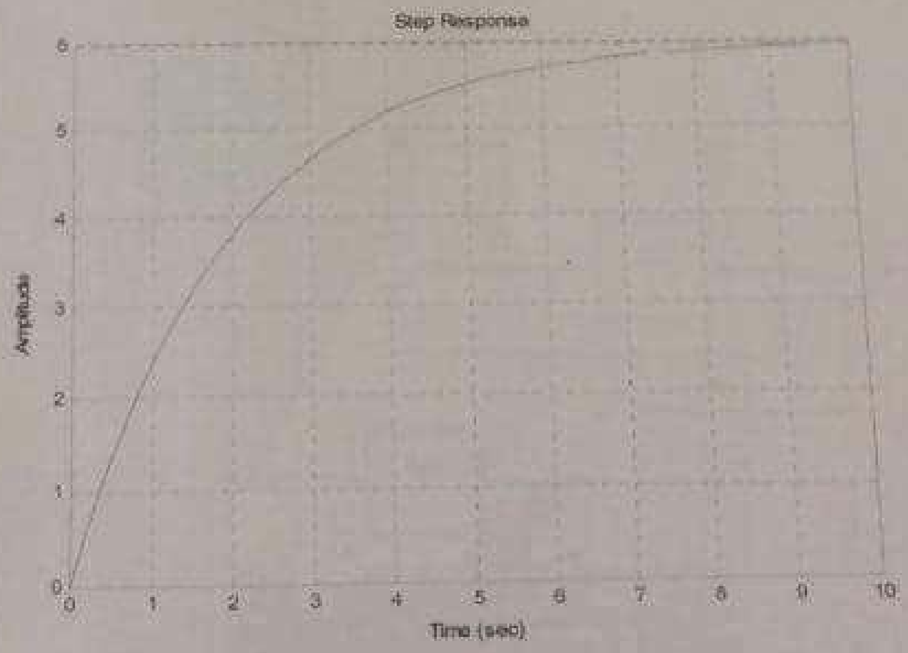
[8 marks]



Q4: A) Determine the type and the order of the following system: [4 marks]



B) step response for a first order system is shown below. Find the transfer function of the system in standard form, if the input signal is 3/s? [6 marks]



Good Luck

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Q1:

A) Calculate the zeroes and poles of the following systems and then draw them in the S-plane: [3 marks]

$$G1(S) = \frac{(S^2 - 16)}{(2S^2 + 14S + 6)} \qquad G2(S) = \frac{(2S + 2)}{(S^2 + 25)}$$

B) Find the Laplace transform for the following functions: [3 marks]

$$f(t) = 3cos4t + 5t^3 + e^{3t}sin2t + 2t^3e^{-4t}$$

C) For the following system, find the inverse Laplace [5 marks]

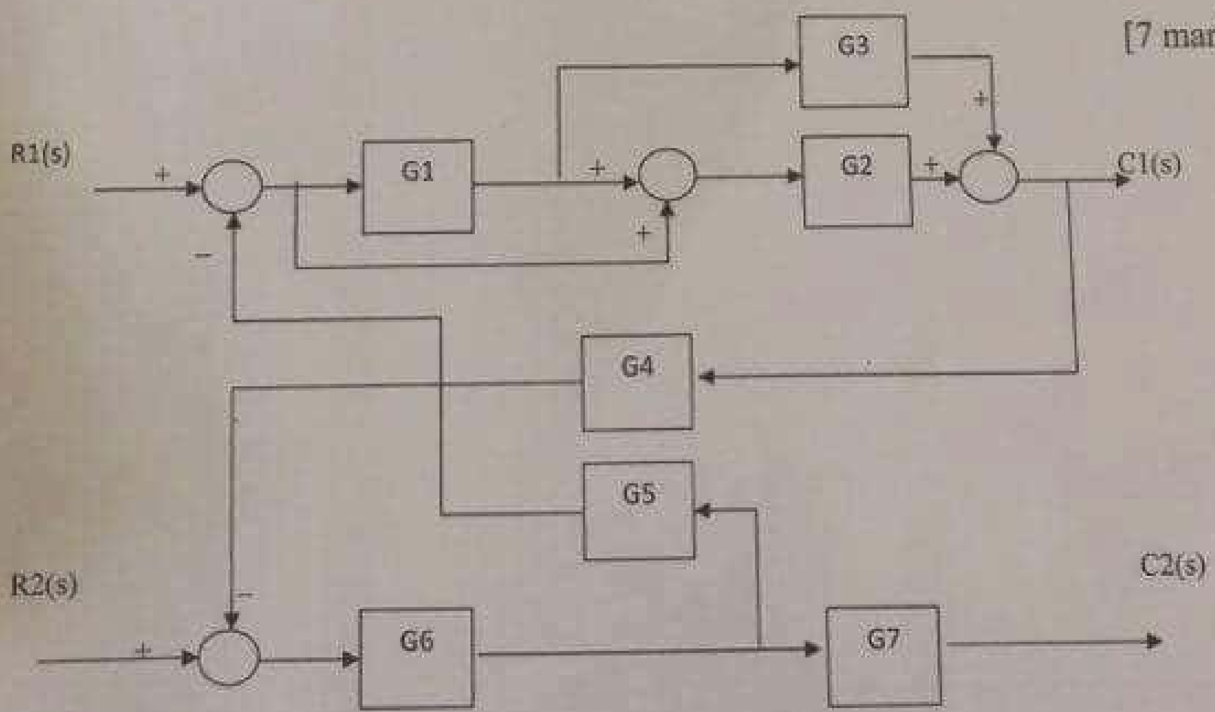
$$G(S) = \frac{3S + 1}{S(S^2 + 6S + 9)}$$

D) Consider the differential equation, where the initial condition are y(0)= -2 and $y^1(0)$= -1, determine Y(s). [4 marks]

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4\,y(t) = 7u(t)$$

Q2: Using Block diagram reduction rules, determine the close loop transfer function (C2/R1)

[7 marks]



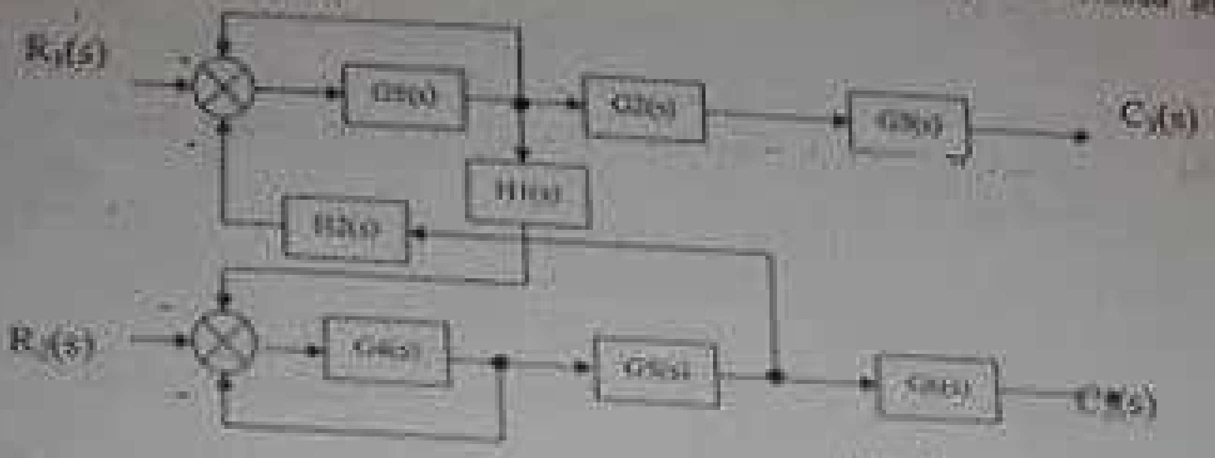
ELECTRONIC TECHNICAL COLLAGE / TRIPOLI

Final exam *Control I* *Time: 2 hours* *Control & communication group*

****

Answer all questions

Q1: a) Using block diagram reduction rules. Determine the closed loop TF $C_2(s)/R_1(s)$ of the system:



Fig(1)

b) Transfer block diagram to it's equivalent signal flow graph, and determine the closed loop TF $C_2(s)/R_1(s)$ using Mason's rule. (Compare the results)

Q2: a) Derive the time response equation C(t) of the 2nd order control system with damping ratio $\xi=1$.

b) A unity feedback control system is shown in fig(2). Determine the relative stability of the system using Routh criterion, and the number of poles, if any, in the R.H.S in S-plane.

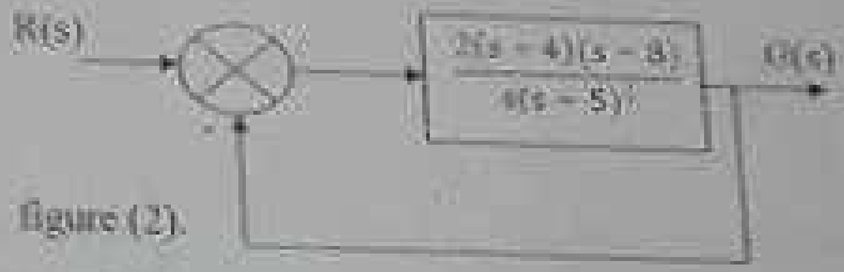


figure (2).

Q3: A feedback control system has a characteristic equation :

$$Q(s) = S^3 + 3KS^2 + (K+2)S + 4 = 0$$

Determine the range of (K) which results in a stable system.

Q3: B) Consider the following electrical Circuit shown in the figure: [10 marks]

a) Obtain the transfer function E_o/E_i

b) Find c(t) when the input signal is (2/s)

c) Determine the final Value.

d) Draw the transient response

Where: $R = 2 \times 10^{5}$, $C = 1 \times 10^{-6}$

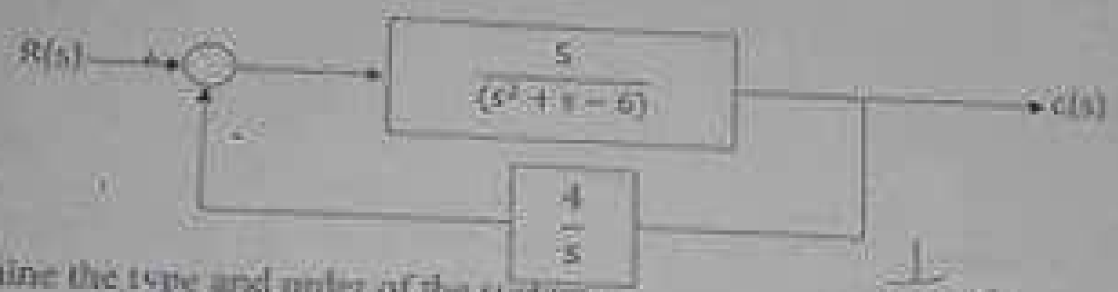
Q4: For the following 2^{nd} order control system: $\frac{C(s)}{R(s)} = \frac{1}{s^2+5s+25}$ [10 marks]

a) Determine values of ζ, W_n, W_d.

b) Find c(t) when the input signal is $\frac{2}{s}$.

c) Determine values of M_p, t_p, t_s, t_r

Q5:A)

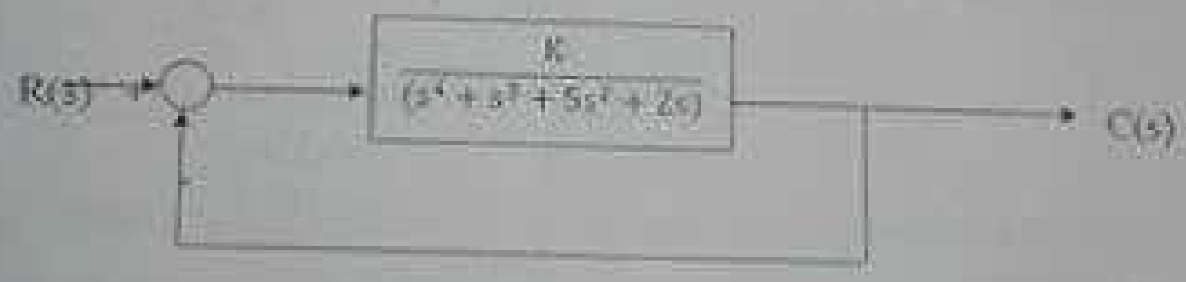


a) Determine the type and order of the system

b) Determine the static error constant (k_p, k_v, k_a). [5 marks]

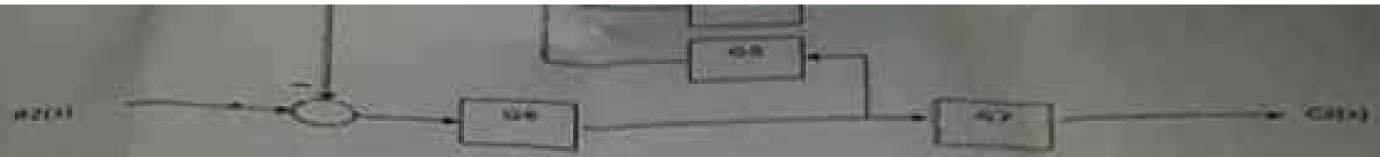
c) Then, find steady state error e_{ss} for step, ramp and acceleration inputs.

Q5:B)



Using Routh criterion determine the range of the gain K for a stable system. [5 marks]

Good Luck



B) Consider the differential equation, where the initial condition are $y(0) = -2$ and $y^{1}(0) = -1$. [6 marks]

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 6\,y(t) = 0$$

i) Determine Y(s).

ii) Calculate the value of zeroes and poles.

iii) Then determine y(t).

Q2: A) Determine the order and the type of the following system, then find the value of K if the steady state error has a constant value of ($e_{ss} = 0.05$), and what is the input signal in this case? what is the best way to eliminate the e_{ss}? [6 marks]

B) By using Routh criterion, test the stability for the following characteristic equation: [6 marks]

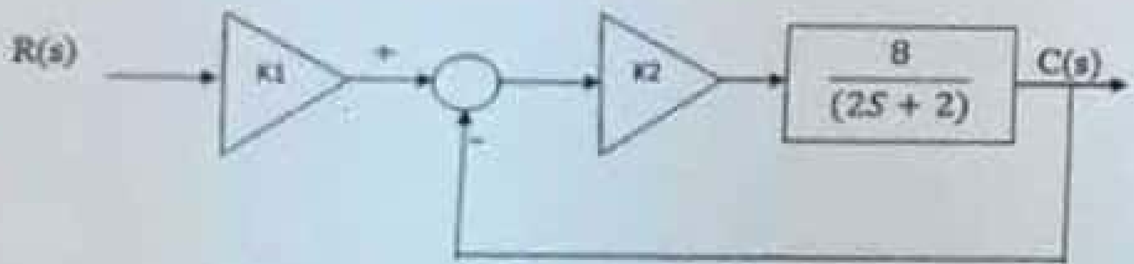
$$6S^6 + 4S^5 + 7S^4 + 2S^3 + 5S^2 + S + 2 = 0$$

then determine how many poles in the RHS and in LHS?

كلية التقنية الالكترونية
College of Electronic Technology - Tripoli
القسم: [illegible]
أسئلة الامتحان النهائي لمادة : الأنظمة الديناميكية والتحكم
لطلبة الفصل: الخامس
رمز المادة: CT311
التاريخ: 2015/12/28
الفصل الدراسي : خريف 2015
اسم الأستاذ/المنسق : هشام الشروي
الزمن: ساعتان
اسم الطالب: ....
رقم القيد ....
المجموعة : ....

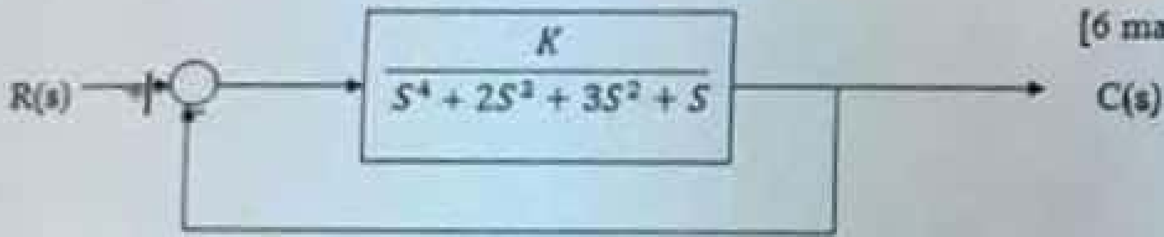
Q3:A) Determine the value of K_1 and K_2 that reduce the value of T to 0.1sec and final value to 60? Where $R(s) = \frac{5}{s}$

[5marks]

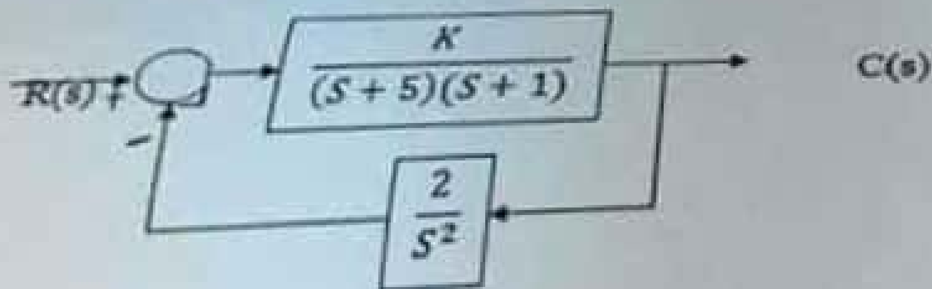


B)) Using Routh criterion determine the range of the gain K for a stable system.

[6 marks]

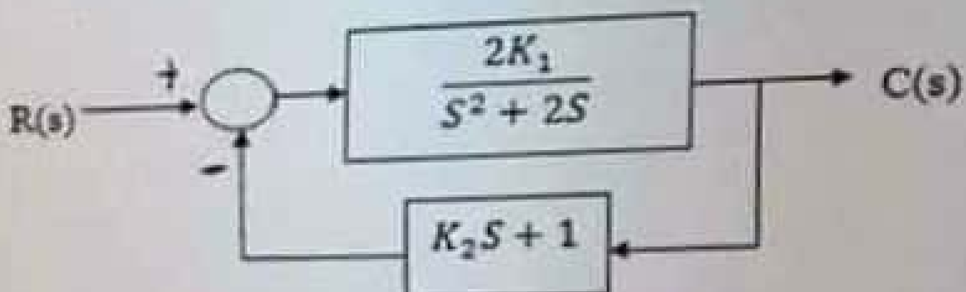


Q4:A) Find the value of K if the steady state error has a constant value of (e_{ss} = 0.05), and what is the input signal in this case? [5 marks]



B) For the closed loop control system shown in the following figure, find the value of the gain K_1 and K_2, So that the $M_p = 50\%$ and the $t_s = 2.25\ sec.$

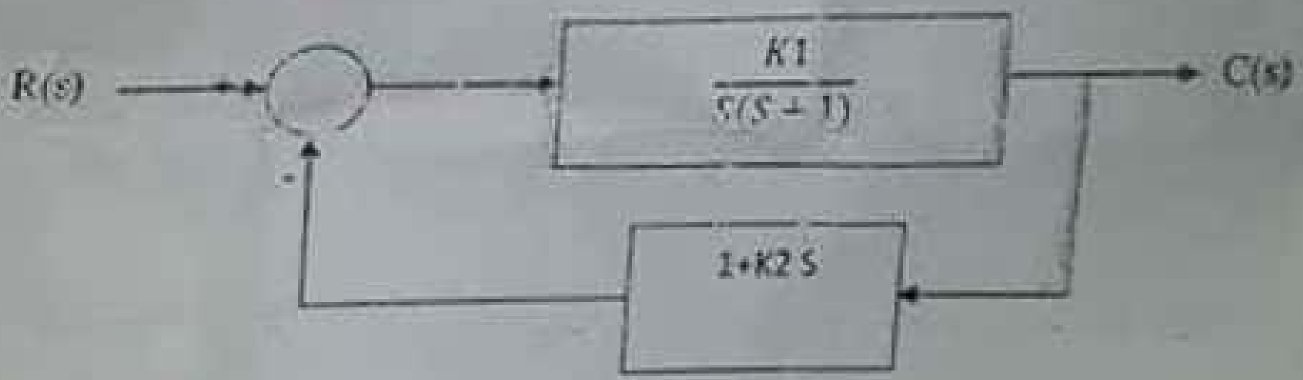
[7 marks]



B) Derive the transfer function of the second order control system, that has the followin

i) $S_{1,2} = \pm 2j$ ii) $S_{1,2} = -2 \pm 2j$

C) For the closed loop control system in the figure: Determine the values of K1 and K2, 20%, and the $t_p = 1\ sec$ and what the value of t_r, and t_s in this case? then write the trans



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Q1:A) Calculate the zeroes and poles of the following systems and then draw them in the S-plane:

[2 marks]

$$G1(S) = \frac{(S^2 - 36)}{(3S^2 + 17S + 6)} \qquad G2(S) = \frac{(2S + 6)}{(S^2 + 81)}$$

B) For the following system, find the inverse Laplace [5 marks]

$$G(S) = \frac{3S + 1}{S(S^2 + 6S + 9)}$$

C) Derive the transfer function of the second order control system, that has the following poles:

1) $S_{1,2} = \pm 2j$ 2) $S_{1,2} = 3 \pm 4j$ [3 marks]

Q2: Using Block diagram reduction rules, determine the close loop transfer function (C2/R1)

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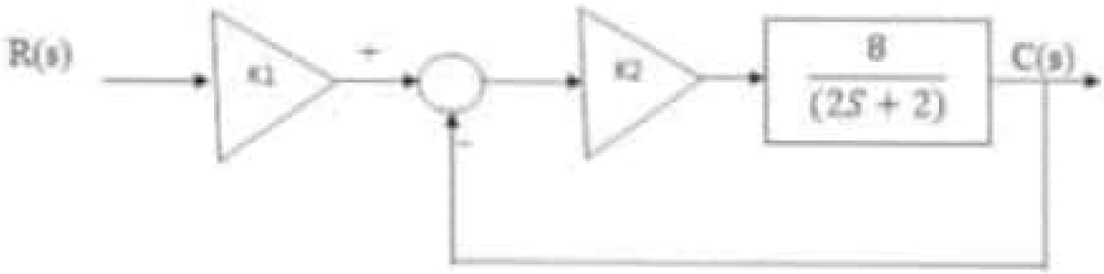
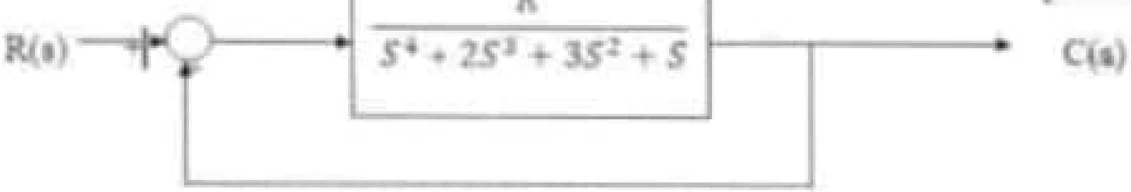
Q3:A) Determine the value of K_1 and K_2 that reduce the value of T to 0.1sec and final value to 60? Where $R(s) = \frac{5}{s}$ [5marks]

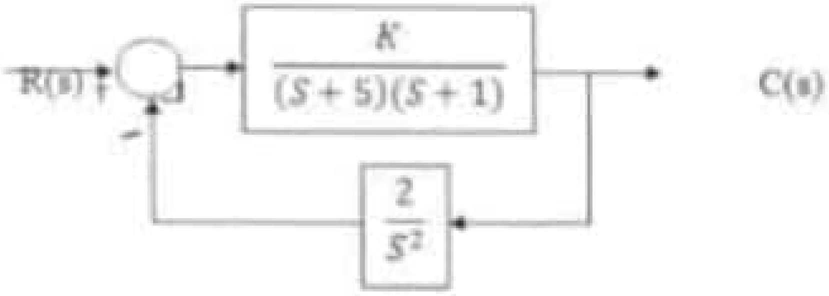


B)) Using Routh criterion determine the range of the gain K for a stable system.

[6 marks]

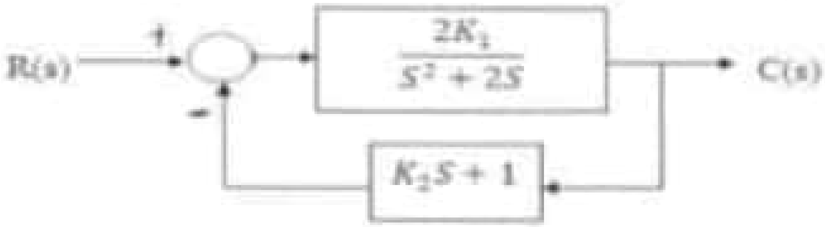


Q4:A) Find the value of K if the steady state error has a constant value of ($e_{ss} = 0.05$), and what is the input signal in this case? [5 marks]



B) For the closed loop control system shown in the following figure, find the value of the gain K_1 and K_2, So that the $M_p = 50\%$ and the $t_s = 2.25\ sec.$

[7 marks]



كلية التقنية الالكترونية

College of Electronic Technology - Tripoli

القســـم: التحكم الآلي أسئلة الامتحان النهائي لمادة: الأنظمة الديناميكية والتحكم

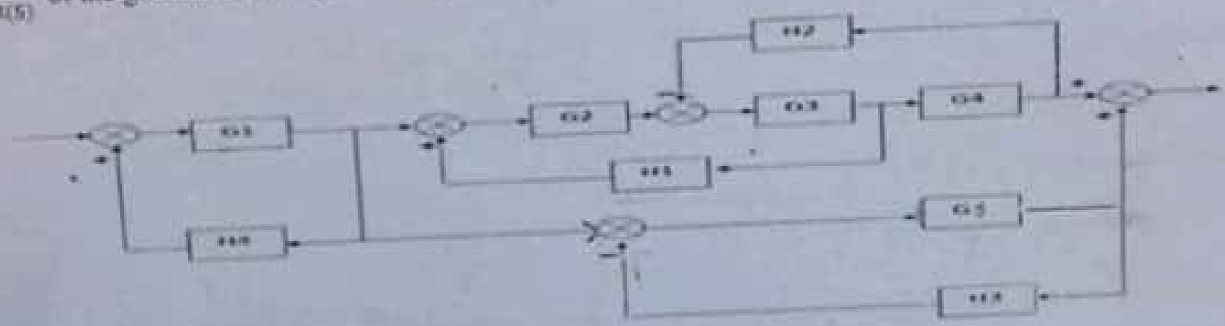
لطلبة الفصل: الخامس رمز المادة: CT311 التاريخ: 2018/02/08

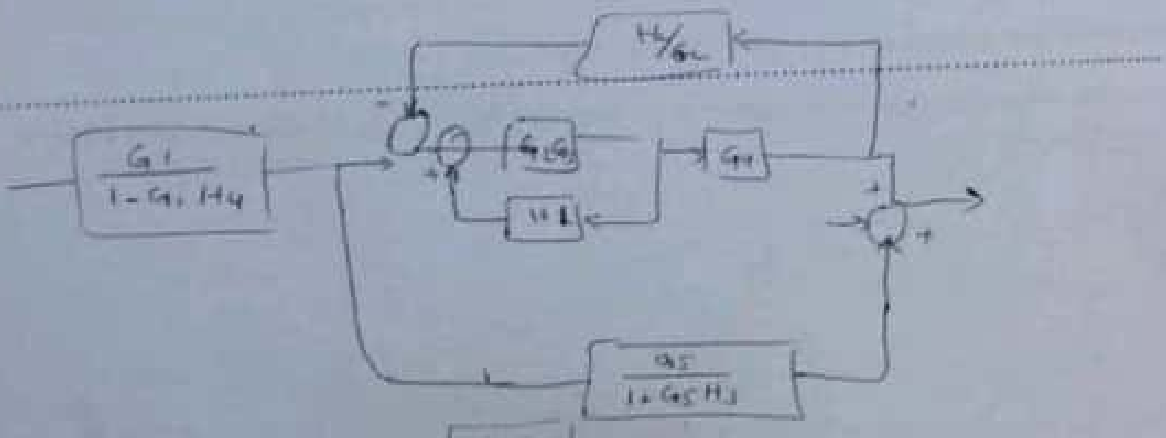
للفصل الدراسي: خريف 2017 اسم الأستاذ: هشام الشروي الزمن: ساعتان

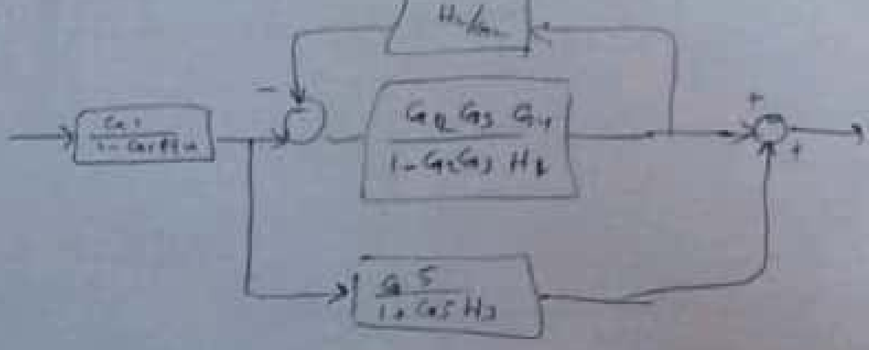
اسم الطالب: .... رقم القيد .... المجموعة: ....

Q5: Using the rules of the block diagram reduction. Find the overall transfer function $\frac{C(S)}{R(S)}$ of the given closed loop control system

[8 marks]







$$\frac{\frac{G_2 G_3 G_4}{1 - G_2 G_3 H_2}}{1 + \frac{G_2 G_3 G_4}{1 - G_2 G_3 H_2} \cdot \frac{H_2}{G_4}}$$

$$\frac{G_2 G_3 G_4}{G_2 G_3 H_2 + G_2 G_3 H_2} + \frac{G_5}{1 + G_5 H_3}$$

مع تمنياتي للجميع بالتوفيق والنجاح

أستاذ المادة: هشام الشروي

Q2: A) Determine the type and the order of the following system:

B) Find the value of K if the steady state error has a constant value of ($e_{ss} = 0.5$), and what is the input signal in this case? [8 marks]

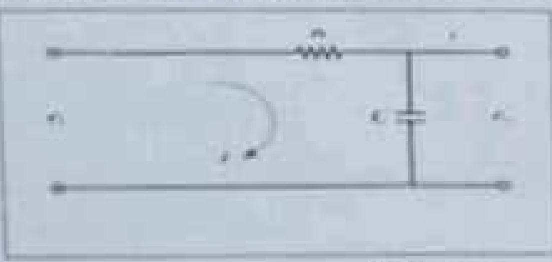
Q3: a) Derive the Eo(s)/Ei(s).

b) Find $e_o(t)$, when the input signal is $\frac{2}{s}$

c) Determine the final value (F.V).

d) Draw the transient response..

where R=2M Ohm C=5μF



[8 marks]

Q4: closed loop control system has a characteristic equation as:

$$S^4 + S^3 + 5S^2 + 2S + k = 0$$

a) Test the stability of the system using Routh criterion at k=15 [8 marks]

b) Determine the range of the gain K for a stable system.

مع تمنياتي للجميع بالتوفيق والنجاح
أستاذ المادة : هشام الشروي