EEE302 CONTROL SYSTEMS
PRE-LABORATORY REPORT

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ASSIGNMENT NUMBER : **2**

OBJECTIVES OF THE LABORATORY ASSIGNMENT:

Objectives of this lab are learning how to reduce of a block diagram with series, parallel or feedback connection by using MATLAB.

CODES:

```
% CONTROL SYSTEM LAB ASSIGNMENT-2
% TURHAN CAN KARGIN 150403005

clear all % clears all variable definitions
close all % closes all figures
clc       % clears the screen

%QUESTION-1)
G1=tf(10,[1 2 10]);
G2=tf(5,[1 5]);
Gk_1=feedback(G1*G2,0) % Series
Gk_2=feedback(G1+G2,0) % Parallel

%QUESTION-2)
G=tf(10,[1 2 10]);
H=tf(5,[1 5]);
Gk_3=feedback(G,H)   %'+'
Gk_4=feedback(G,-H)  %'-'


%QUESTION-3)
G1_1=tf(2,[1 9 8]);
H=0.2;
G3_1=tf([1],[1 0]);
G2_1=4;
Z=feedback(G1_1,H)
GL=feedback(Z*G2_1*G3_1,1)
```

```
% COMMAND WINDOW

Gk_1 =

            50
  ----------------------
  s^3 + 7 s^2 + 20 s + 50


Gk_2 =

    5 s^2 + 20 s + 100
  ----------------------
  s^3 + 7 s^2 + 20 s + 50


Gk_3 =

         10 s + 50
  ------------------------
  s^3 + 7 s^2 + 20 s + 100


Gk_4 =

      10 s + 50
  -----------------
  s^3 + 7 s^2 + 20 s


Z =

         2
  ---------------
  s^2 + 9 s + 8.4


GL =

             8
  ----------------------
  s^3 + 9 s^2 + 8.4 s + 8
```

SOLUTIONS:

QUESTION-1 :

Control Systems

LAB ASSIGNMENT-2

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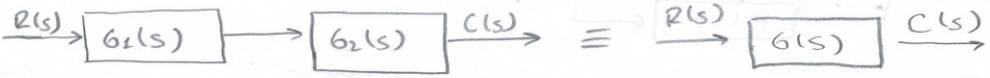
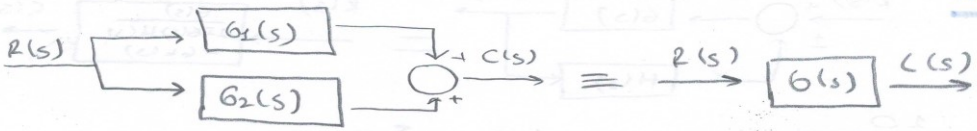
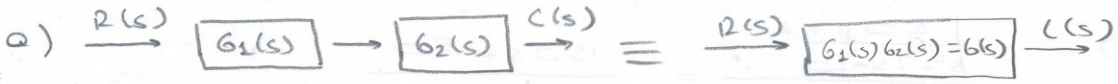
Question-1) = Find $G_1(s)$ and $G_2(s)$ equal $\frac{10}{s^2+2s+10}$, $\frac{5}{s+5}$ respectively, reduce the blocks connected in series and parallel

a) 

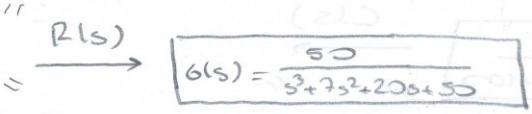
= method2

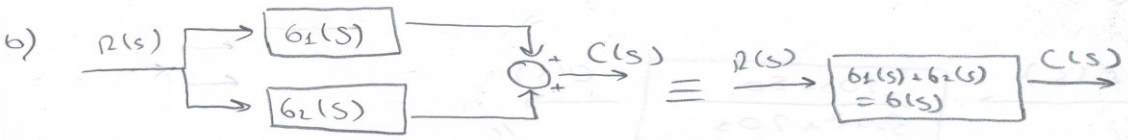
b) 

Solution =

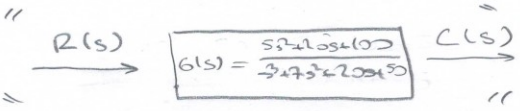
a) 

* $G(s) = G_1(s)\,G_2(s) = \frac{10}{s^2+2s+10} \cdot \frac{5}{s+5} = \frac{50}{s^3+7s^2+20s+50}$



b) 

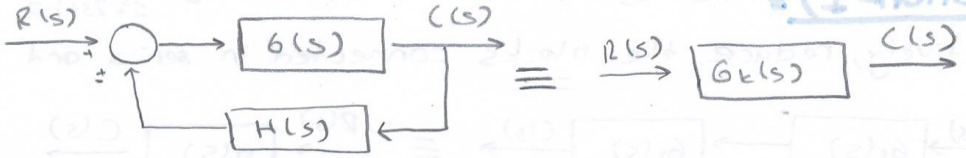
* $G(s) = G_1(s) + G_2(s) = \frac{10}{s^2+2s+10} + \frac{5}{s+5} = \frac{5s^2+20s+100}{s^3+7s^2+20s+50}$



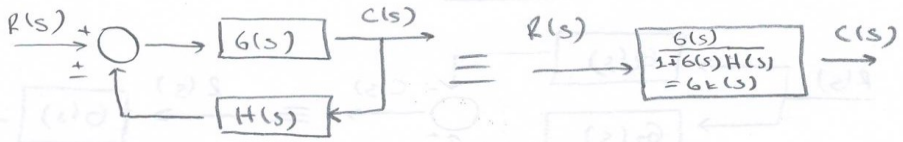
QUESTION-2 :

Question-2)

If G(s) and H(s) equal $\frac{10}{s^2+2s+10}$, $\frac{5}{s+5}$ respectively, reduce blocks connected with feedback connection.



Solution=



$$G_k(s) = \frac{\frac{10}{s^2+2s+10}}{1+\frac{10}{s^2+2s+10}\cdot\frac{5}{s+5}} = \frac{10s+50}{s^3+7s^2+20s+100}$$

$$G_k(s) = \frac{\frac{10}{s^2+2s+10}}{1-\frac{10}{s^2+2s+10}\cdot\frac{5}{s+5}} = \frac{10s+50}{s^3+7s^2+20s}$$

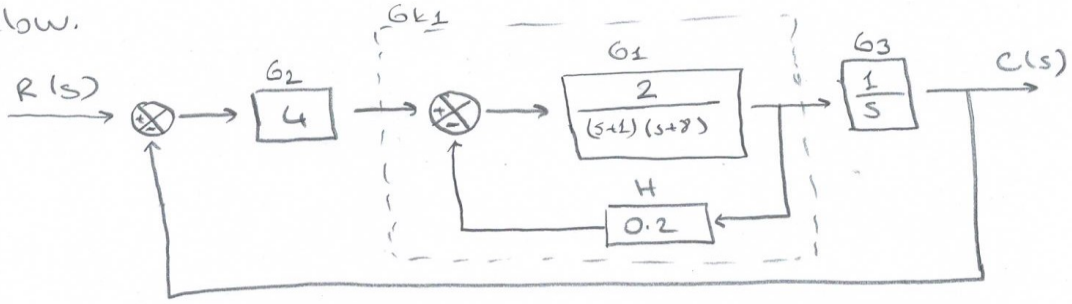
a) R(s) → $\frac{10s+50}{s^3+7s^2+20s+100}$ → C(s)

b) R(s) → $\frac{10s+50}{s^3+7s^2+20s}$ → C(s)

QUESTION-3:

Question-3)

Find the closed loop transfer function of the system given below.



Solution=

$$G_{k1} = \frac{\frac{2}{s^2+9s+8}}{1+\frac{2\times 0.2}{s^2+9s+8}} = \frac{2}{s^2+9s+8.4}$$

$$G_2 \times G_{k1} \times G_3 = 4 \times \frac{2}{s^2+9s+8.4} \times \frac{1}{s} = \frac{8}{s^3+9s^2+8.4s}$$

$$Z = \frac{\frac{8}{s^3+9s^2+8.4s}}{1+\frac{8}{s^3+9s^2+8.4s}} = \frac{8}{s^3+9s^2+8.4s+8}$$

$$R(s) \longrightarrow \boxed{G_L = \frac{8}{s^3+9s^2+8.4s+8}} \longrightarrow C(s)$$