ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

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Section: C(1)

Course no.: EEE 4606
Assignment no : 2

Assignment 1

```
clc;
clear all;
close all;

G1 = tf( 1, [1 1 5] );
G2 = tf( 1, [1 2] );
Gc = G1;
Gv = G1;
H = G1;
T1 = parallel(G1,G2);
T_final = feedback(Gc*Gv*T1,H)
```

```
T_final =

           s^4 + 3 s^3 + 14 s^2 + 17 s + 35

  -------------------------------------------------

  s^9 + 6 s^8 + 34 s^7 + 116 s^6 + 339 s^5

          + 742 s^4 + 1290 s^3 + 1801 s^2

                                      + 1627 s + 1257

Continuous-time transfer function.
```

2.

```
5   G1 = tf( 1, [1 1 5] );
6   G2 = tf( 1, [1 2] );
7   Gc = G1;
8   Gv = G1;
9   H = G1;
10  T1 = parallel(G1,G2);
11  T_final = feedback(Gc*Gv*T1,H)

12  G3 = G1;
13  Kc = G1;
14  H = G1;
15  T1 = feedback(G1,G2);
16  T_final = feedback(Kc*G3*T1,H)
```

```
                                      + 1627 s + 1257

Continuous-time transfer function.
T_final =

              s^3 + 3 s^2 + 7 s + 10

  -------------------------------------------------

  s^9 + 6 s^8 + 34 s^7 + 117 s^6 + 342 s^5

          + 760 s^4 + 1321 s^3 + 1890 s^2

                                      + 1701 s + 1377

Continuous-time transfer function.
```

3.

```
clc;
clear all;
close all;
G1 = tf( 1, [1 1 1] );
G2 = G1;
G3 = G1;
G4 = G1;
KL = G1;
ip1 = 1;
op1 = 3;
connection_matrix1 = [1 -3;
 2 1;
 3 2;
```

```
connection_matrix1 = [1 -3;
 2 1;
 3 2;
 4 0;
 5 0];

system1 = append(G1,G2,G3);
final1 = connect(system1,connection_matrix1,ip
tf_final1 = tf(final1)
final11 = minreal(tf_final1)
ip2 = [4 5];
op2 = 3;
connection_matrix2 = [1 -3 0;
 2 1 4;
```

```
tf_final1 =

                          1
  -----------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2

Continuous-time transfer function.
```

```
final11 =

                          1
  -----------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2
```

```
final11 = minreal(tf_final1)
ip2 = [4 5];
op2 = 3;
connection_matrix2 = [1 -3 0;
 2 1 4;
 3 2 5;
 4 0 0;
 5 0 0];

system2 = append(G1,G2,G3,G4,KL);
final2 = connect(system2,connection_matrix2,ip
tf_final2 = tf(final2)
final12 = minreal(tf_final2)
```

```
tf_final1 =

                          1
  ---------------------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2 + 3 s + 2

Continuous-time transfer function.
final11 =

                          1
  ---------------------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2 + 3 s + 2

Continuous-time transfer function.
tf_final2 =

  From input 1 to output:
                                s^2 + s + 1
  ---------------------------------------------
Continuous-time transfer function.
final11 =

                       1
  -------------------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2 + 3 s + 2

Continuous-time transfer function.
tf_final2 =

  From input 1 to output:
                             s^2 + s + 1
  ---------------------------------------------------------------------
  s^8 + 4 s^7 + 10 s^6 + 16 s^5 + 19 s^4 + 16 s^3 + 11 s^2 + 5 s + 2

  From input 2 to output:
                    s^4 + 2 s^3 + 3 s^2 + 2 s + 1
  ---------------------------------------------------------------------
```

```
  From input 2 to output:
                    s^4 + 2 s^3 + 3 s^2 + 2 s + 1
  ---------------------------------------------------------------------
  s^8 + 4 s^7 + 10 s^6 + 16 s^5 + 19 s^4 + 16 s^3 + 11 s^2 + 5 s + 2

Continuous-time transfer function.
final12 =

  From input 1 to output:
                         1
  ------------------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2 + 3 s + 2

  From input 2 to output:
                   s^2 + s + 1
  ------------------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2 + 3 s + 2
```


```
  From input 2 to output:
                    s^4 + 2 s^3 + 3 s^2 + 2 s + 1
  ---------------------------------------------------------------------
  s^8 + 4 s^7 + 10 s^6 + 16 s^5 + 19 s^4 + 16 s^3 + 11 s^2 + 5 s + 2

Continuous-time transfer function.
final12 =

  From input 1 to output:
                         1
  ------------------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2 + 3 s + 2

  From input 2 to output:
                   s^2 + s + 1
  ------------------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2 + 3 s + 2

Continuous-time transfer function.
```

4.

```
K1 = tf([0 4],[0 1]);
K2 = tf([0 1],[1 2]);
K3 = tf([1 0],[0 1]);
K4 = tf([1 0],[2 1]);
G1 = tf([0 1],[1 1]);
G2 = tf([2 0],[0 1]);
system = append(K1,G1,K3,K4,G2,K2);
ip = [1 4];
op = 5;
connection_matrix = [ 1 0 0; 2 1 6; 3 2 6
final = connect(system, connection_matrix
final_1 = tf(final);
final_2 = minreal(final_1)
```

```
  ----------------------------------------
  s^6 + 3 s^5 + 6 s^4 + 7 s^3 + 6 s^2 + 3 s

Continuous-time transfer function.

final_2 =

  From input 1 to output:
  -8 s^3 - 16 s^2 + 6.616e-16 s
  -----------------------------
          s^2 - 3 s - 2

  From input 2 to output:
  -s^4 - 3 s^3 - 2 s^2 - 2.981e-16 s - 5.938
  ------------------------------------------
            s^3 - 2.5 s^2 - 3.5 s - 1

Continuous-time transfer function.
```

5.

```
G1 = tf([0 4],[0 1]);
G2 = tf([0 1],[1 2]);
G4 = tf([1 0],[2 1]);
Gc = tf([1 0],[0 1]);
K1 = tf([0 1],[0 1]);
K2 = K1;
H = tf([0 10],[0 1]);
system = append(Gc,G1,G2,K1,K2,G4,H);
ip = [1 4];
op = 5;
connection_matrix = [ 1 -7 0;
    2 1 0;
```

```
ip = [1 4];
op = 5;
connection_matrix = [ 1 -7 0;
    2 1 0;
    3 2 -6;
    4 0 0;
    5 3 4;
    6 3 4;
    7 3 4];
final = connect(system, connection_matrix, ip, op);
final_1 = tf(final);
final_2 = minreal(final_1)
```

```
final_2 =

  From input 1 to output:
  0.09756 s^2 + 0.04878 s + 7.453e-20
  -----------------------------------
        s^2 + 0.561 s + 0.02439

  From input 2 to output:
  0.02439 s^2 + 0.06098 s + 0.02439
  ---------------------------------
       s^2 + 0.561 s + 0.02439

Continuous-time transfer function.
```

6.

```
K1 = tf([0 4],[0 1]);
G2 = tf([0 1],[1 2]);
G3 = tf([1 0],[0 1]);
G4 = tf([1 0],[2 1]);
H1 = tf([0 10],[0 1]);
H2 = tf([2 10],[0 1]);
system = append(K1,G2,G3,G4,H2,H1);
ip = [1 3 4];
op = 4;
connection_matrix = [ 1 -6 0; 2 1 -5; 3 2 0; 4 3 0; 5 3 0; 6 4 0];
final = connect(system, connection_matrix, ip, op);
final_1 = tf(final);
final_2 = minreal(final_1)
```

```
final_2 =

  From input 1 to output:
              s^2
  ----------------------------
  s^3 + 16 s^2 + 3.75 s + 0.5

  From input 2 to output:
  0.25 s^3 + 0.5 s^2 + 5.527e-17 s - 5.083e-19
  -------------------------------------------
          s^3 + 16 s^2 + 3.75 s + 0.5

  From input 3 to output:
  0.5 s^3 + 2.75 s^2 + 0.5 s
  ----------------------------
  s^3 + 16 s^2 + 3.75 s + 0.5

Continuous-time transfer function.
```

7.

```
K = tf(1,2);
G1 = tf([10 470],1);
G2 = tf(2,[1 5 0]);
G3 = tf(20,[1 0]);
G4 = tf(1,[1 1]);
G5 = tf(1,[1 0]);
H1 = tf(3,[1 2 5]);
H2 = tf([1 0],1);
H3 = tf(10,1);
H4 = tf(1,1);
ip = 1;
op = 6;
connection_matrix = [1 -6 0 0;
```

```
H4 = tf(1,1);
ip = 1;
op = 6;
connection_matrix = [1 -6 0 0;
2 1 -10 0;
3 2 0 0;
4 3 -8 -9;
5 4 0 0;
6 5 7 0;
7 4 0 0;
8 5 7 0;
9 6 0 0;
10 3 0 0];
system = append(K,G1,G2,G3,G4,G5,H2,H3,H4,H1);
final = connect(system,connection_matrix,ip,op);
```

```
tf_final1 =

       0.995 s^5 + 49.75 s^4 + 148.3 s^3 + 381.1 s^2 + 332.3 s + 233.8
  ------------------------------------------------------------------------
  s^7 + 8.1 s^6 + 24.79 s^5 + 159 s^4 + 3079 s^3 + 3576 s^2 + 3427 s + 514.4

Continuous-time transfer function.
```

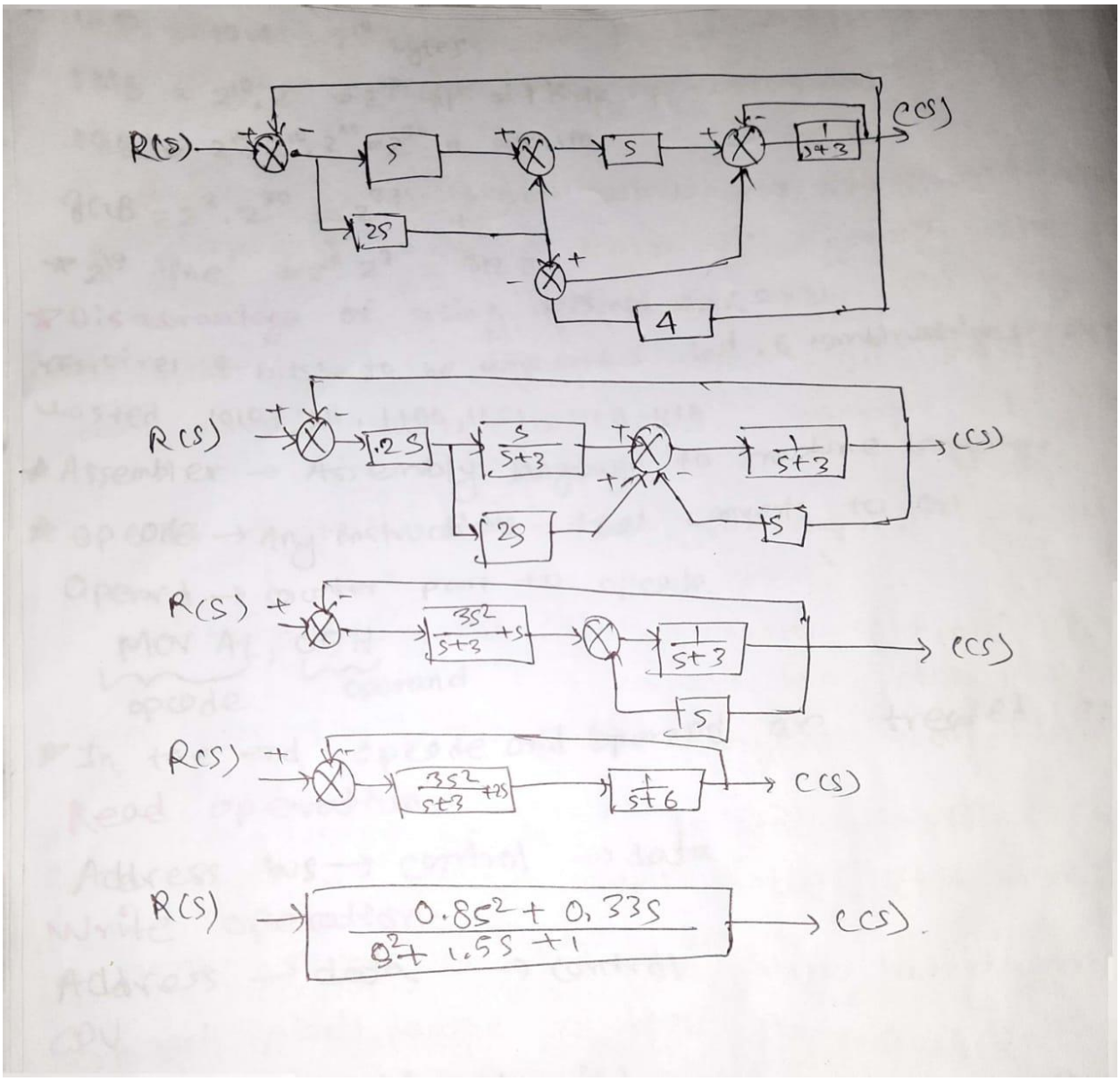
```
final = minreal(tf_final1)
```

```
final =

       0.995 s^5 + 49.75 s^4 + 148.3 s^3 + 381.1 s^2 + 332.3 s + 233.8
  ------------------------------------------------------------------------
  s^7 + 8.1 s^6 + 24.79 s^5 + 159 s^4 + 3079 s^3 + 3576 s^2 + 3427 s + 514.4

Continuous-time transfer function.
```

8.


R(s)
5
5
1/(s+3)
C(s)
2s
4
R(s)
1.2s
s/(s+3)
1/(s+3)
C(s)
2s
1
R(s)
3s²/(s+3) + s
1/(s+3)
C(s)
1
R(s)
3s²/(s+3) + 2s
1/(s+6)
C(s)
R(s)
(0.8s² + 0.33s) / (s² + 1.5s + 1)
C(s)

```
G1 = tf([1 0],1);
G2 = G1;
G3 = tf(1,[1 1]);
G4 = tf([2 0],1);
G5 = tf(4,1);
G6 = tf(1,1);
ip = 6;
op = 3;
connection_matrix = [1 -3 6 0 0;
2 1 4 -2 0;
3 -3 2 4 -5;
4 -3 6 0 0;
5 3 0 0 0;
6 0 0 0 0];
system = append(G1,G2,G3,G4,G5,G6);
final = connect(system, connection_matrix, ip, op);
tf_final = tf(final)
```

```
tf_final =

  0.8333 s^2 + 0.3333 s - 5.3e-17
  -------------------------------
          s^2 + 1.5 s + 1

Continuous-time transfer function.
```

```
final = tf(tf_final)
```

```
final =

  0.8333 s^2 + 0.3333 s - 5.3e-17
  -------------------------------
          s^2 + 1.5 s + 1

Continuous-time transfer function.
```