Istanbul Technical University
Faculty of Electrical and Electronics
Department of Control and Automation Engineering

Feedback Control Systems
(KON313E)

Homework Assignment 1

Prepared By

Student ID 1: ..... **2015 - 2016 Fall Term**
Student ID 2: ..... **Deadline: 26.10.2015**

FEEDBACK CONTROL SYSTEMS (KON 313E)

HOMEWORK ASSIGNMENT - 1 SOLUTIONS

Question 1.a:

- Differential equation,

- By Laplace Transformation,

- By Inverse Laplace Transformation,

- Result,

Question 1.b:

- f(t) function,

- By Laplace Transformation,

Question 1.c:

- If the expression is rearranged,

- By Inverse Laplace Transformation,

Question 1.d:

- By Laplace Transformation,

- With the help of X(s),

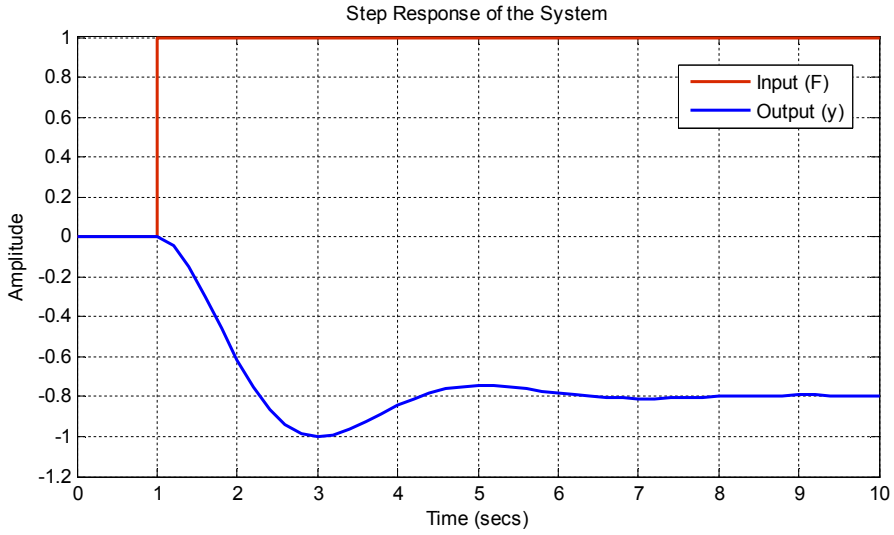
- $\frac{Y(s)}{U(s)}$ transfer function,

Question 2.a:

- Peak time: $t_p =$ …… seconds

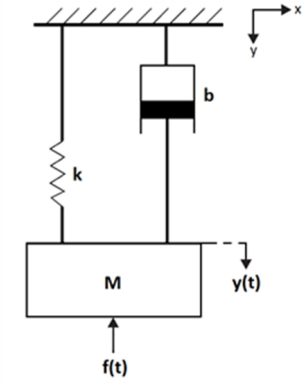
- Open-loop gain:

- Calculation of the overshoot,



Question 2.b:

- Open-loop transfer function:



- Calculation of the parameters,

Question 2.c:

- Damping ratio:

- Natural frequency:

Question 2.d:

- Parameter to be changed:

- Its new value:

Question 3.a:

- Open-loop transfer function,

Question 3.b:

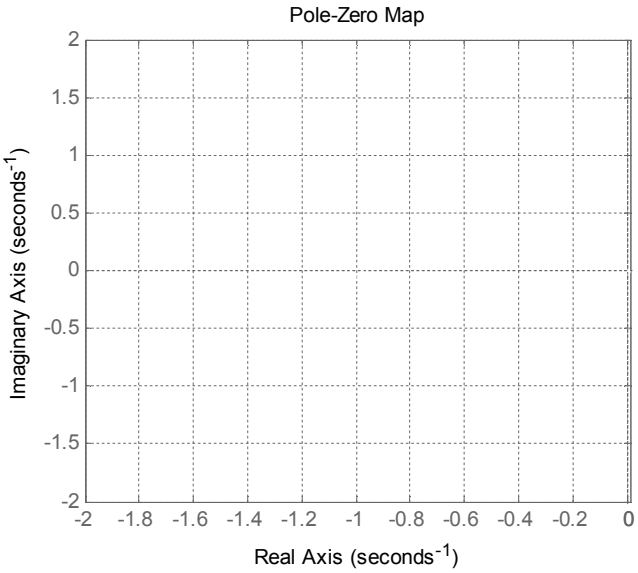
- Order of the system:

- Pole locations:

- Zero locations:

- Stability:

- Poles and zeros in s-domain:



Question 3.c:

- A suitable K_p value: ◯ Exists ◯ Does not exist
- Explanation:

Question 3.d:

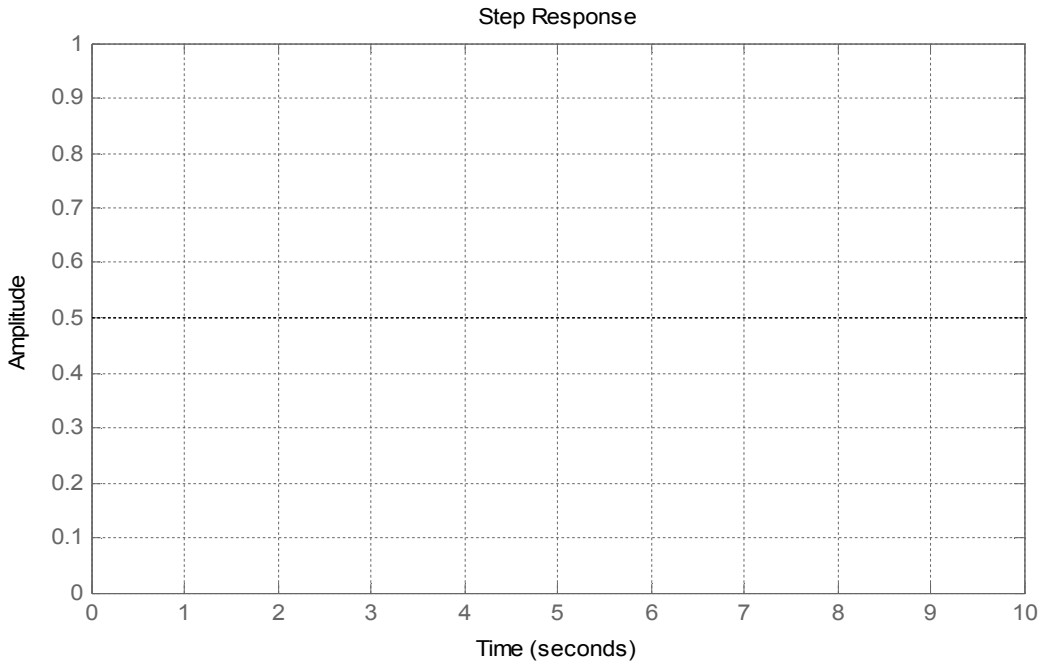
MATLAB

```
s = tf('s');
Gs = … / …
Step(Gs)
```

Mathematica 9

```
Gs = TransferFunctionModel[ … / … , s];
gt = OutputResponse[Gs, UnitStep[t], t];
Plot[gt, {t, 0, 10}, PlotRange -> {{0, 10}, {0, 1}}]
```

- Draw both responses on the same figure:



- Comments:

Question 4:

4.a: ◯ True ◯ False

Reason:

4.b: ◯ True ◯ False

Reason:

4.c: ◯ True ◯ False

Reason:

4.d: ◯ True ◯ False

Reason:

4.e: ◯ True ◯ False

Reason:

4.f: ◯ True ◯ False

Reason:

4.g: ◯ True ◯ False

Reason:

4.h: ◯ True ◯ False

Reason: