**King Saud University**

**College of Computer and Information Sciences**

**Computer Engineering Department**

**First Semester, 1438-1439 H Academic Year (2017-2018 G)**

**CEN455**

**Introduction to digital control**

# Midterm 1 Exam Time: 90 minutes

**Student Name: Student No:**

**Question Score Max Score**

**1 \_\_\_\_\_\_ 7**

**2 \_\_\_\_\_\_ 7**

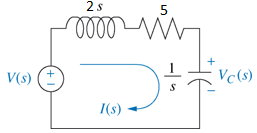
**3 \_\_\_\_\_\_ 6**

**TOTAL \_\_\_\_\_\_ 20**

***Question 1:***

1. Solve for y, if all initial conditions are zero (use Laplace transform**)**.

2. Find the transfer function relating capacitor voltage, , to input voltage,



***Solution:***

1. Using s-transform for both sides

1

Using partial fraction expansion

1

Using inverse Laplace transform

1

2. Using the mesh

0.5

0.5

0.5

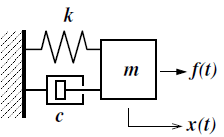
The transfer function

2

Dividing by

0.5

**Question 2:**



1. Consider the system where is the external excitation

force, is the displacement of the center of mass m,

c is the linear viscous damping coefficient, and

k is the linear elastic stiffness coefficient.

Find the transfer function, *X(s)/F(s),* for the system

2. Find the state-space representation in phase-variable form for the transfer function

***Solution:***

1.

1

Using Laplace transform for both sides

1

The transfer function

1.5

Dividing by

0.5

2.

0.5

0.5

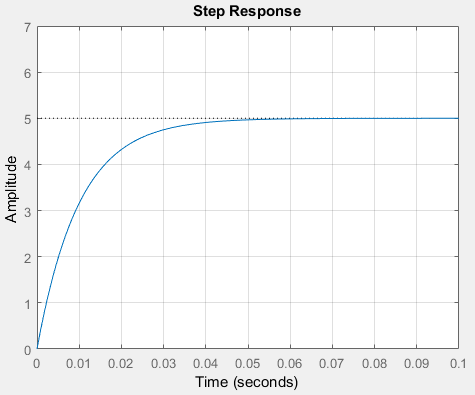
0.5

1

0.5

**Question 3:**

For a step response shown in the following figure, find the transfer function of the system. Also find rise time and settling time.



***Solution:***

Let, the transfer function 

1

Final output = 5

0.5

63% of the final output is 5 x 0.63 = 3.15

0.5

Time to reach 3.15 is 0.01,

Therefore,

0.5

0.5

1

1

1