Umm Al-Qura Universtiy, Makkah

Department of Electrical Engineering

Control (802331)

Term 2; 2016/2017

Solution Midterm Exam

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Max Marks: 60 Section 1

**Q1.** [15] For the following three inputs two outputs system, find the transfer function matrix.

**Solution:**

For this system

Or

If, and

If , and

If , and

Now

So the transfer function matrix:

Or

**Q2.** [5, 5, 5] A 2nd order system has poles located at .

1. Find the “undamped natural frequency” of the system.
2. Find the “damping coefficient” of the system.
3. What kind of response does the system has (oscillatory, decaying oscillation, growing oscillations or no oscillations)? Is system stable?

**Solution:**

Poles location:

1. Decaying oscillation. Stable.

**Q3.** [2, 4, 4, 3, 2] Consider the 1st order system consisting of RC series circuit shown here. Input voltage is and output voltage is . The transfer function for this system is given by

Where

1. Find the value of “time constant - ”
2. If input voltage is find the expression for output voltage .
3. After how long the capacitor will be 50% charged?
4. What will be the output voltage after 20 m-Sec?
5. What will be steady-state voltage at the output?

**Solution:**

Hence the output voltage

**Q4.** [15] An LTI system is described by the transfer function

Find the output of the system if the input is given by

**Solution:**

Hence

|  |  |
| --- | --- |
|  |  |

Laplace transform

|  |  |
| --- | --- |
| Unit impulse:  | 1 |
| Unit step: 1 |  |
| Unit ramp:  |  |
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