**Subject:** Linear Control System (EE-321)  **Assignment No:** 03

**Title:** Control of DC Motor  **Semester:** 6th

**Date: 0**1 May. 2020**Due Date:** N.A

**Teacher:**  Dr. Imran Khan

**Note:**

* Answer the following questions.
* Be neat and precise.
* This assignment covers CLO: 03 and CLO: 04 of the course.

The equations of motion of a DC Motor are given below.



Where the parameters of the motor are as follows:

* moment of inertia of the rotor (J) = 3.2284E-5 kg.m2/s2
\* damping ratio of the mechanical system (b) = 3.5077E-6 N-m-s
\* electromotive force constant (K=Ke=Kt) = 0.0274 N-m/Amp
\* electric resistance (R) = 4 Ohm
\* electric inductance (L) = 2.75E-6 H
\* input (V): Source Voltage
\* output (theta): position of motor shaft
* assume J\*L=0

Perform the following

1. Find the transfer function $θ(s)/V(s)$? (This part should be handwritten on your assignment)
2. Simulate the above (both in MATLAB and Simulink) i.e., find its open loop step response? (This step should be mentioned with code/Simulink diagram) and supporting figures)
3. Design a compensator using root locus such that

$t\_{r}\leq 0.2 sec,$ overshoot ($M\_{P})$ ≤ 30% (i.e., $ω\_{n}≈10\frac{rad}{s},$ $ξ≈0.5$) and steady-state reference tracking with zero error if there is no disturbance. However, if a step disturbance ($T\_{d}$, which may be considered as the load torque) is present then. Response to a step disturbance of 0.2 V should be rejected to less than 10% error in steady state. Try to get the disturbance rejected as quickly as possible.

(The design should be performed by hand. You should find all the controller parameters and then verify your results using simulation i.e., bring your controller in closed loop with the plant designed in part 2. Properly designed figures should support your design)