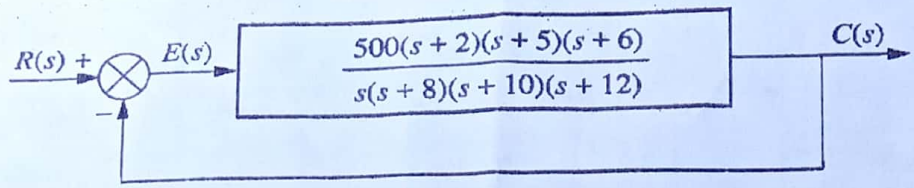
Electrical Engineering Department
UET, FSD Campus

Final-Term Exam
**Time:90 min , Marks=40**

**EE340 Control Systems**
5th Semester(Session 2018)

Reg. No. **2018-EE-** 386

| Q | | | | |
|---|---|---|---|---|
| 1 | **Evaluate** the static error constants and find the steady-state error for the standard step, ramp and parabolic input for the system given below.<br>  <br> | CLO2 | PLO3 | 8 |
| 2 | **Examine** root locus of following functions<br>**(A)**<br>$$H(s)G(s) = \frac{1}{s^3 + 8s^2 + 17s + 10}$$<br>**(B)**<br>$$H(s)G(s) = \frac{1}{s^4 + 2s^3 + 2s^2}$$ | CLO3 | PLO2 | 16 |
| 3 | **Calculate** a compensator to get $Ess = 0.2$ of given function which should have minimum effect on root locus<br>$$G(s) = \frac{5s^3 + 9s^2 + 20s + 10}{32s^3 + 84s^2 + 2s + 19}$$ | CLO3 | PLO2 | 4 |
| 4 | **Analyze** the effect of PID controller to the unity feedback closed loop of following function<br>$$G(s) = \frac{\omega_n{}^2}{s^2 + 2\xi\omega_n s}$$ | CLO3 | PLO2 | 6 |
| 5 | **Examine** the bode plot of<br>$$H(s) = \frac{50j\omega}{(j\omega + 4)(j\omega + 10)^2}$$ | CLO3 | PLO2 | 6 |

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Mid Term Exam, 5th Semester(Session 2018)

Q. **Time: 1Hr, Marks=30**

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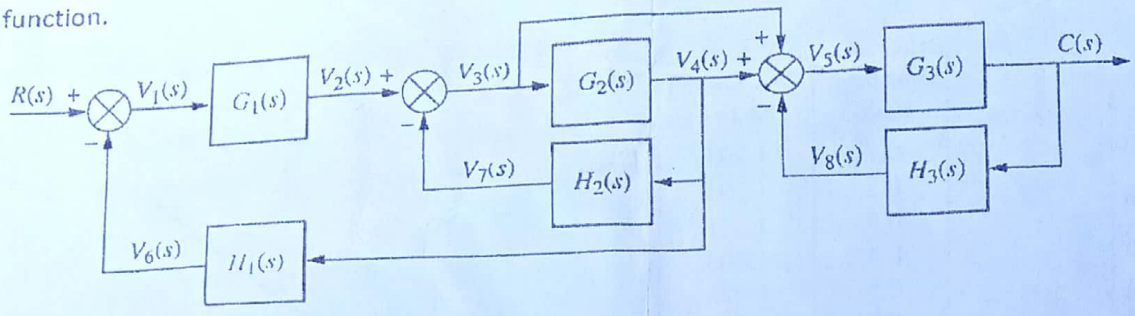
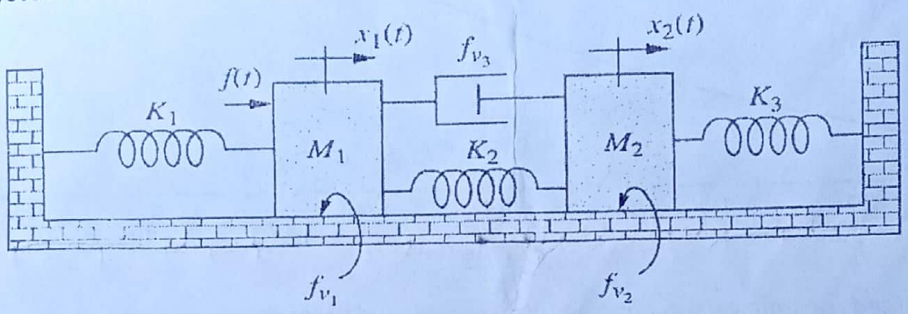
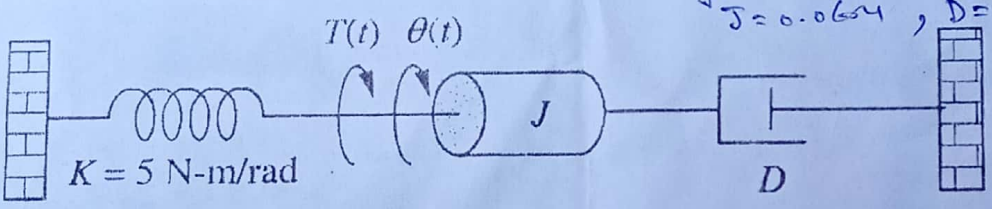
|---|---|---|---|---|
| 1 | **Apply** block diagram reduction techniques to reduce the system given below in single transfer function.   | CLO1 | Cognitive | 08 |
| | | | Level 3 | |
| | | | PLO1 | |
| 2 | **Apply** the mechanical modelling techniques to find the transfer function $X_2(s)/F(s)$ of the following system.   | CLO1 | Cognitive | 08 |
| | | | Level 3 | |
| | | | PLO1 | |
| 3 | **Select** the values of J and D to yield 20% overshoot and a settling time of 2 sec for a step input of torque T(t) for the system given below   $\zeta = 0.22$, $\omega_n = 9.09$ $J = 0.0654$, $D = 0.2415$ | CLO2 | Cognitive | 06 |
| | | | Level 5 | |
| | | | PLO3 | |
| | **Evaluate** the natural frequency, damping ratio, settling time and rise time of the system whose transfer function is given below **and if** the response is underdamped also find the peak time and percentage overshoot for the system. Mention the response type. $$G(s) = \frac{100}{s^2 + 15s + 100}$$ | CLO2 | Cognitive | 0 |
| | | | Level 5 | |
| | | | PLO 3 | |

| Damping ratio | Normalized rise time |
|---|---|
| 0.1 | 1.104 |
| 0.2 | 1.203 |
| 0.3 | 1.321 |
| 0.4 | 1.463 |
| 0.5 | 1.638 |
| 0.6 | 1.854 |
| 0.7 | 2.126 |
| 0.8 | 2.467 |
| 0.9 | 2.883 |

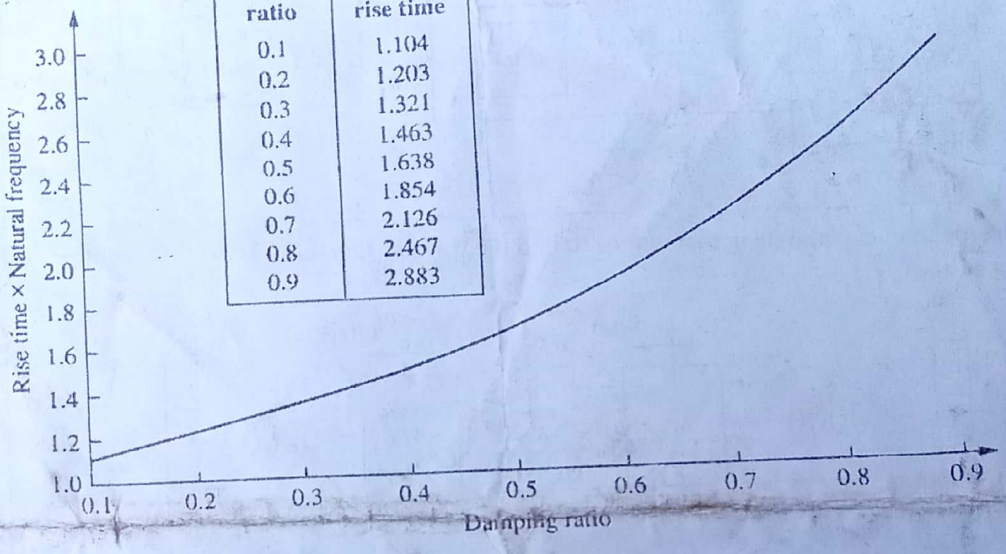



*Figure 1: Normalized rise time versus damping ratio for a second order underdamped response.*