

Roll No.: _____

National Institute of Technology Delhi

Name of the Examination: Mid-Semester Examination (Spring 2023)

Branch: EE

Semester: 4th

Title of the Course: Control Systems

Course Code: EEB 252

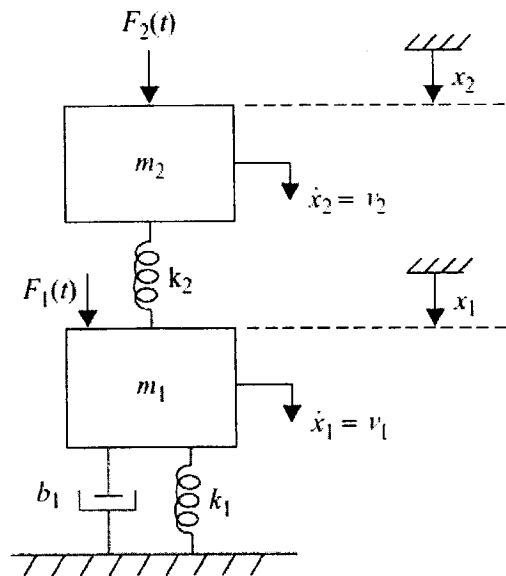
Time: 1.5 hours

Maximum Marks: 25

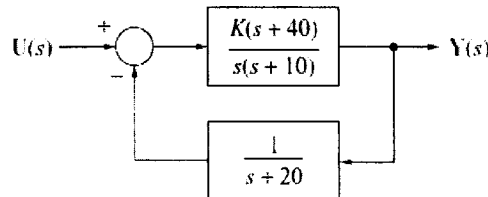
Note :1.All the five questions are compulsory. Each question is of 05 marks.

2.All the symbols have their usual meaning. Make suitable assumptions wherever required.

1. Obtain the transfer functions $X_1(s)/F_2(s)$ and $X_2(s)/F_2(s)$ for the system shown below.



2. Determine the range of gain K for which the closed-loop system shown below is stable.



3. The sensitivity of a feedback control system, with overall transfer function $T(s)$, with respect to the variation in transfer function $M(s)$ is defined by

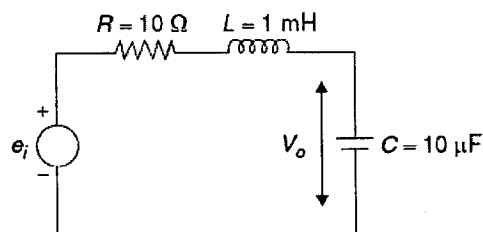
$$S_M^T = \frac{dT(s)/T(s)}{dM(s)/M(s)}$$

Using this definition, compute the following:

- Sensitivity of feedback system to variation in the forward path transfer function.
- Sensitivity of feedback system to variation in the feedback path transfer function.

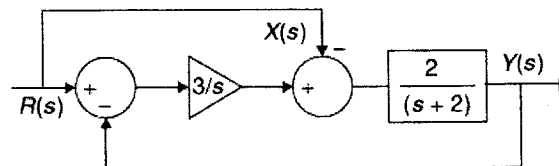
Compare the results obtained in (a) and (b) above.

4. Consider the following RLC network.



Calculate the maximum overshoot in the response when subjected to a unit-step input. Also, find the time at which the maximum peak occurs.

5. The system shown below is subjected to a unit-step input.



Calculate the steady-state error of the closed-loop system.