SET 2

Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Control Engineering **Semester: VII**
Program: B. Tech ADE **Time : 03 hrs.**
Course Code: ECEG 4014P **Max. Marks: 100**

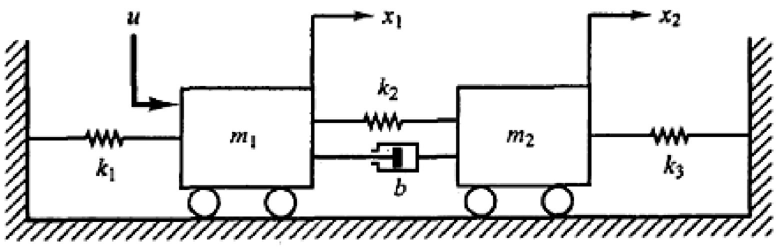
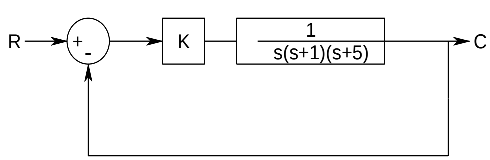
Instructions: Attempt all the question.

SECTION A
(5Qx4M=20Marks)

S. No.	Attempt all the question.	Marks	CO
Q 1	What are the basic components of a feedback control system?	**4**	**CO1**
Q 2	What do you understand by sensor. How sensor affect the closed loop system?	**4**	**CO1**
Q3	What do you understand by control system design? Explain the types of control system design?	**4**	**CO1**
Q 4	Differentiate between transient and steady-state stability?	**4**	**CO2**
Q 5	For a second order system compare the unit step input time response for various values of ζ (damping ratio)	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Comment on the stability and location of poles of the given characteristic equation, $1+G(s)H(s)= 2s^6+5s^5+3s^4+6s^3+5s^2+6s+1$.	**10**	**CO2**
Q 7	A first-order closed-loop control system is defined by T(s) = K/(s+2a).If a unit step input is applied, the system response reaches 40 % of its steady state value in 20 sec. How much time will it take the response to reach 90% of the steady state value? Plot the curve also?	**10**	**CO2**
Q 8	Elucidate the mathematical equation of PID controller. What is the advantage of PI controller over PD controller?	**10**	**CO3**
Q 9	Obtain the transfer function for the mechanical system as shown in figure 1.	**10**	**CO3**

	 Figure 1. Translational Mechanical System		
SECTION-C **(2Qx20M=40 Marks)**			
Q 10 (a) (b)	Obtain the transfer functions for the following systems with state-space models available as: a. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u\,; \quad y = [1 \quad 0]\begin{bmatrix}x_1\\ x_2\end{bmatrix} + [0]u$ Explain the concepts of observability and controllability with reference to linear time invariant systems. Find the controllability of the system described by the state equation. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \left[\begin{pmatrix}0 & 1\\ -2 & 0\end{pmatrix}\right]\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 3\end{bmatrix}u$	**10** **10**	**CO3**
Q 11	Find the break-away points of the root locus defined for G(s)H(s)= K/s(s+4)(s+5)? What will be the value of K so that the closed loop system shown in figure becomes marginally stable?  	**10** **10**	**CO4**