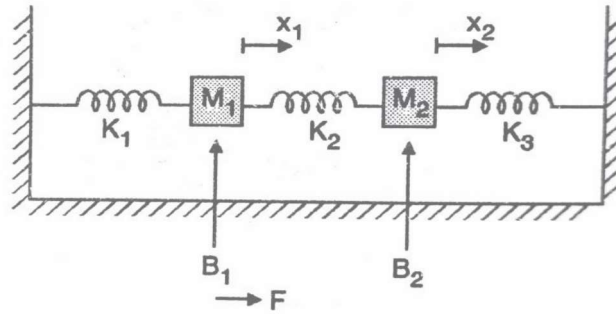


GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023****Subject Code:3131101****Date:26-07-2023****Subject Name:Control Systems****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Explain Close Loop System with Block diagram & Example.	03
	(b) Discuss Force-Current (F-I) analogous system with analogous quantity.	04
	(c) Define: Transfer function, Loop Gain, Steady-state error, Path Gain	07
Q.2	(a) Discuss following terms with respect to Frequency response analysis. (i) Resonant Peak (ii) Resonant Frequency (iii) Bandwidth	03
	(b) Explain standard test signals.	04
	(c) Discuss Unit-step time response of Second-order systems for $\xi > 0$.	07
OR		
	(c) Consider a system represented by the following equations. Draw the Signal Flow Diagram of the system. $X_1 = 6X_0 + 3X_2$, $X_2 = 12X_1 + 5X_2 + 2X_3$ $X_3 = 2X_2 + 3X_4$, $X_4 = 11X_3$	07
Q.3	(a) List properties of M-circles.	03
	(b) Explain the Stable, Marginally stable and Unstable systems with diagram.	04
	(c) Explain rules for block-diagram reduction technique.	07
OR		
Q.3	(a) What is polar plot? Explain in brief.	03
	(b) Derive the expressions for error constants K_p , K_v & K_a corresponding to step, ramp and parabolic input respectively.	04
	(c) System-1 has transfer function $G_1(s) = \frac{30}{4s^2 + 3s + 6}$ and System-2 has transfer function $G_2(s) = \frac{2}{s+4}$. Find Cascade and parallel transfer function for system 1 and system 2.	07
Q.4	(a) Explain: Root locus And Centroid	03
	(b) Explain the frequency response, state its application with possible limitations.	04
	(c) Discuss Lag compensator. Obtain the transfer function of a Lag Compensator.	07
OR		
Q.4	(a) Describe Correlation between transfer function and state space equations.	03
	(b) Discuss Nyquist stability criterion.	04
	(c) Draw the equivalent mechanical system of the system shown in the figure Write the set of equilibrium equation for it and obtain electrical analogous circuit using F-V Analogy.	07



- Q.5 (a) Explain concept of Relative stability. 03
 (b) Write a short note on state space representation of a control system. 04
 (c) Obtain the Root-locus plot for the unity feedback system with transfer 07
 function.

$$G(s) = \frac{k}{s(s+2)}$$

OR

- Q.5 (a) Define: State & State Vector 03
 (b) Write short note on PID controller. 04
 (c) By Hurwitz, find stability of $s^4 + 8s^3 + 18s^2 + 16s + 5 = 0$ 07

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