Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2150909 **Date: 06/06/2019**

Subject Name: Control System Engineering

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.**

			MARKS
Q.1	**(a)**	Explain transfer function and write its advantages and dis advantages.	**03**
	(b)	Give difference between open loop and close loop control system	**04**
	(c)	Define the following terms. (1)control system(2) plants (3)process(4)disturbance(5)controller (6)output (7)input	**07**
Q.2	**(a)**	Explain in brief mass son's gain formula	**03**
	(b)	Explain any two properties of Laplace transform	**04**
	(c)	Obtain the overall transfer function of the system whose block diagram is given in following Figure-1 using block diagram reduction technique	**07**
		OR	
	(c)	Obtain the transfer function C/R from the signal flow graph shown in Figure-2	**07**
Q.3	**(a)**	State the advantages of frequency response method.	**03**
	(b)	Consider characteristic equation of closed loop control system as $S^3+3KS^2+(K+2)S+4=0$ Find range of K Using R-H criterion so that system is stable.	**04**
	(c)	Write the governing differential equations of the mechanical system shown in Figure-3 .Write analogous electrical equations based on Force-voltage analogy. Draw the corresponding circuit diagram.	**07**
		OR	
Q.3	**(a)**	Explain standard test signals used in the control system.	**03**
	(b)	Derive steady state error constants of the Type-0 system for a Ramp input	**04**
	(c)	Derive the transfer function of armature controlled D.C. motor	**07**
Q.4	**(a)**	State and explain nyquist stability criteria	**03**
	(b)	Give comparisons between block diagram and signal flow graph in brief.	**04**
	(c)	Draw the root locus plot for a system having open loop transfer function $G(s)H(s) = K/s(s+1)(s+3)$ Determine gain margin for K=6	**07**
		OR	
Q.4	**(a)**	Define: rise time, peak over shoot and settling time	**03**
	(b)	Explain about the time constant of first order system.	**04**
	(c)	Explain Type 0, Type 1 and Type 2 control system. Derive equation for the steady state error of the Type 2 control system for step, ramp and parabolic input.	**07**
Q.5	**(a)**	Write short note on PID controller.	**03**
	(b)	What are the special cases of Routh's criterion? Explain in brief?	**04**

(c) A unity feedback system is characterized by an open loop transfer function G(S)=K/s(s+10).determine the gain K, so that the system will have a damping ratio of 0.5.for the value of K ,determine settling time, peak overshoot and time to peak overshoot for a unit step input. **07**

OR

Q.5 **(a)** Define: Phase margin and Gain margin **03**

(b) State the advantages of bode plot. **04**

(c) For the given electrical system shown in the Figure-4. Determine (i) transfer function model(2)state variable model **07**

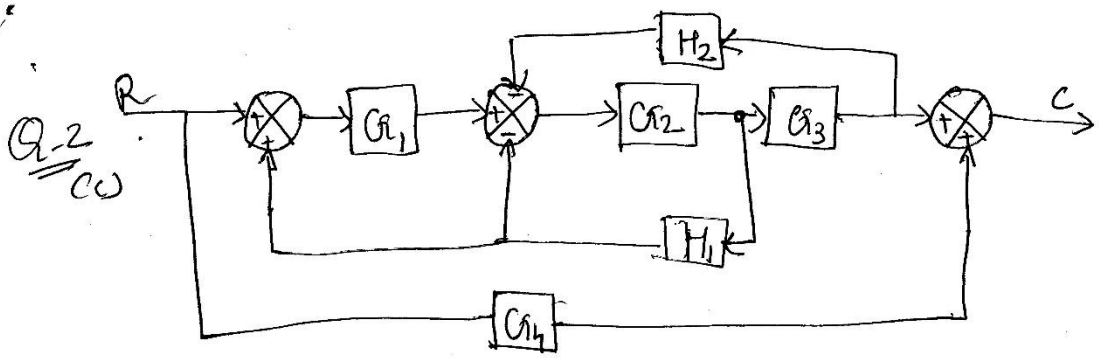

Figure-1

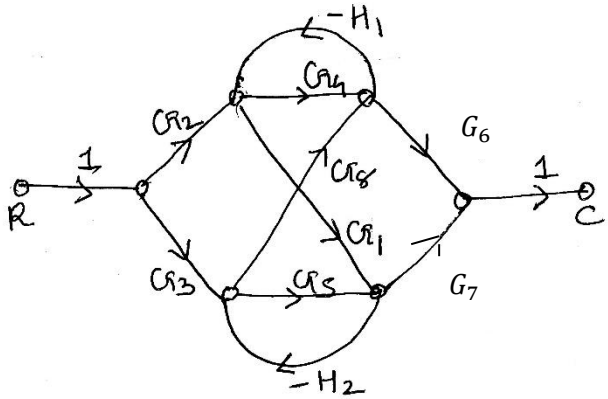

Figure-2

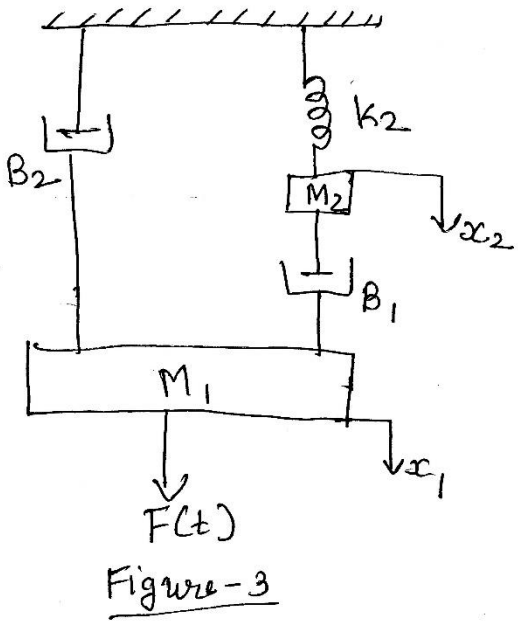

Figure-3

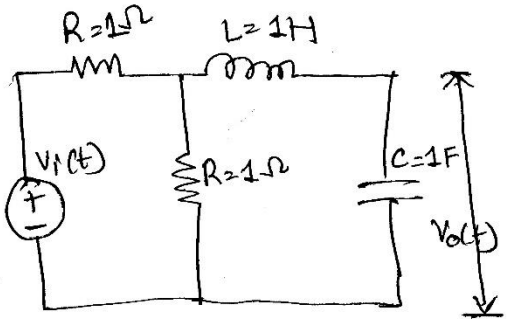

Figure-4

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