GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– VI (New) EXAMINATION – WINTER 2019

Subject Code: 2160104   **Date: 11/12/2019**

**Subject Name: Basic Control Theory**

**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)**	Differentiate Open-loop and Closed-loop control system.	03
	(b)	List rules for Block Diagram Reduction Techniques	04
	(c)	Using Mason's Gain Formula, Find the transfer function C(S)/R(S) for the Signal Flow Graph shown in figure.	07
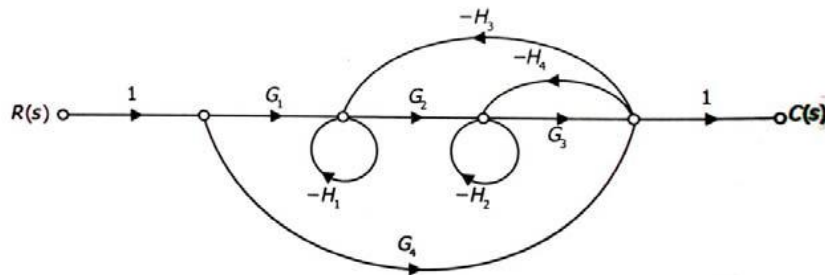
Q.2	**(a)**	Explain standard test signals.	03
	(b)	State and explain Mason's gain formula.	04
	(c)	Reduce the Block Diagram to its Simple Form and obtain C(S)/R(S).	07
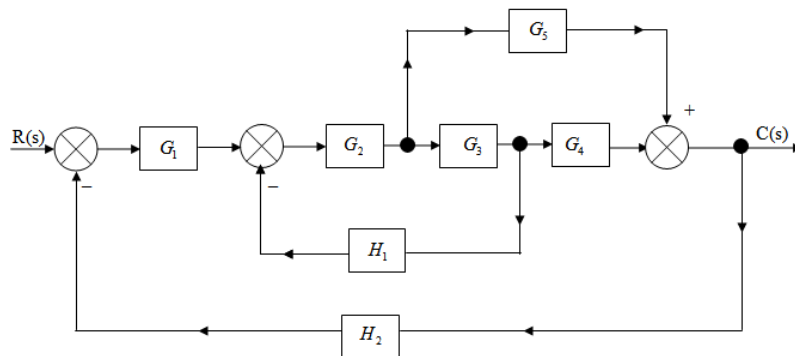
OR

	(c)	For the mechanical system shown in figure, (1) Draw the node diagram (2) Write System equations of performance (3) Draw Force to Voltage analogous circuit.	07
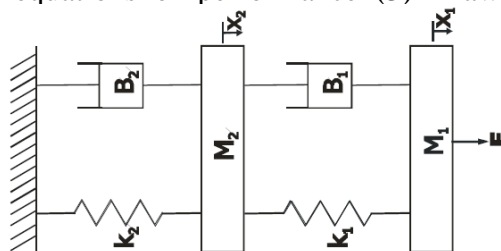
Q.3	**(a)**	By means of Routh criterion, determine the stability of the system described by characteristic equation, $S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$	03
	(b)	Explain types of the system and steady state error constants for the same.	04

(c) What is transfer function? Gives one advantage and disadvantage of its **07**
Derive transfer function of impulse response.

OR

Q.3 **(a)** Describe steady state error. **03**

(b) Explain ON-OFF controller with neutral zone. **04**

(c) A unity feedback control system has G(s) =K/s(s+10)(s²+4s+5) . Determine **07**
the Range of K for closed loop system to stable.

Q.4 **(a)** Draw the polar plot of $G(s) = 1/s$ **03**

(b) Which two plots constitute Bode plot? What steps are followed to sketch Bode **04**
plot?

(c) Plot the root locus for given transfer function. G(s) = K/s(s+1)(s+4). **07**

OR

Q.4 **(a)** For a unity feedback control system $G(s) = \dfrac{10}{s^2 + 4s + 50}$, obtain steady **03**

state error for step input.

(b) Write the rules for drawing root locus **04**

(c) Draw the bode plot for the system having G(s)H(s)=20/s(0.1s+1). Determine **07**
the Gain Margin and Phase Margin.

Q.5 **(a)** State Nyquist stability criterian. **03**

(b) Compare classical control theory with conventional control theory. **04**

(c) Find the eigen values for the following matrix. **07**

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}$$

OR

Q.5 **(a)** Define state and state variables. **03**

(b) Obtain second order step response for the under damped case. **04**

(c) Explain PI Controller. List Advantages, Disadvantages and Applications of it. **07**

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