Seat No.: Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2140307 Date:28/05/2019

Subject Name: Control System and Analysis

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)**	What are standard Test Signals and their Significance?	**03**
	(b)	Explain Liquid Level - Electrical system Analogy.	**04**
	(c)	Explain Open loop and Closed loop control system with examples.	**07**
Q.2	**(a)**	What is Linear time invariant control system?	**03**
	(b)	Derive Unit Step response of First order system.	**04**
	(c)	Find system equations and F-I and F-V analogous circuits for mechanical system shown in Fig.1.	**07**

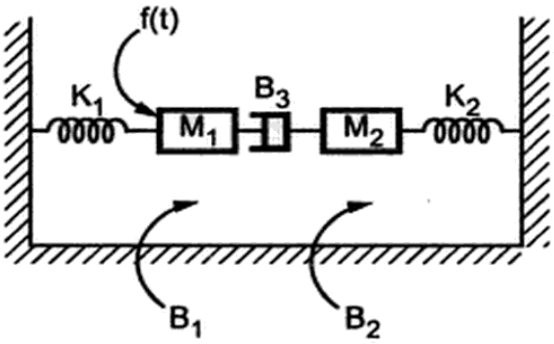

Fig.1.

OR

	(c)	Draw the mechanical network. Write differential equations of performance and also draw the analogous electrical circuit of the system shown below in Fig.2.	**07**

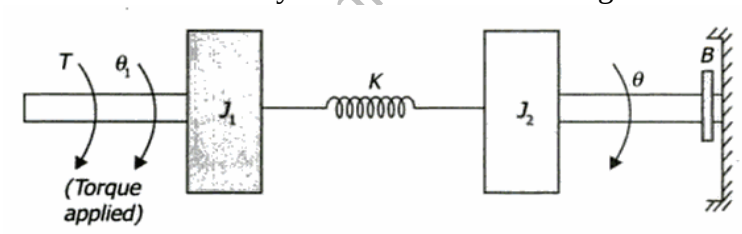

Fig.2.

Q.3	**(a)**	What are the essential characteristics of Signal Flow Graphs?	**03**
	(b)	Find the inverse Laplace transform of $F(s) = \frac{(s+2)}{s(s+3)(s+4)}$	**04**
	(c)	Using Block diagram reduction techniques, find the closed loop transfer functions of the following system shown in Fig.3.	**07**

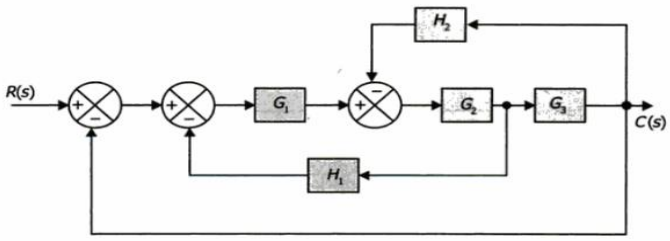

Fig.3.

OR

Q.3 **(a)** Define stability. Describe types of stability for control system. **03**

(b) The impulse response of a system is $1 - e^{-2t}$. Find the transfer function. **04**

(c) Find the transfer function C(s)/ R(s) for the signal flow graph shown in Fig. 4. **07**

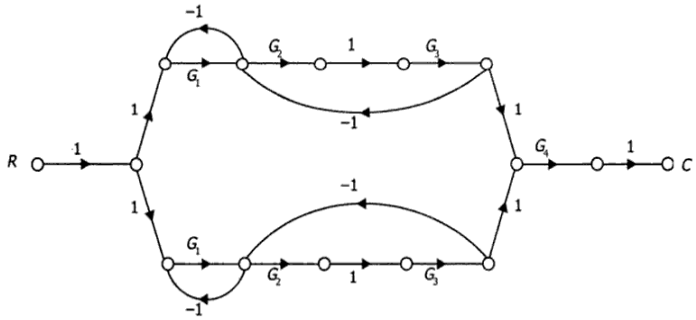

Fig.4.

Q.4 **(a)** Define: Rise time, Settling time, Delay time. **03**

(b) For a unity feedback system the OLTF is $G(S) = \frac{(s+1)}{s^2(s+2)(s+3)}$. What is the steady state error if the input r(t) = $(2+3t+4t^2)$ u(t). **04**

(c) The open loop transfer function of a unity feedback control system is given by, $G(S) = \frac{25}{S(S+5)}$. Determine time domain specifications. **07**

OR

Q.4 **(a)** Write advantages and disadvantages of Routh's Stability Criterion? **03**

(b) Test the stability of a system whose characteristics equation is, $S^3+5S^2+6S+30 = 0$. **04**

(c) The open loop transfer function of a unity feedback control system is given by, $G(S) = \frac{10}{(S+1)(S+10)}$. **07**

a) Find K_p , K_v , K_a

b) Find the steady state error for an input of 5u(t), 5tu(t), $5t^2$u(t).

Q.5 **(a)** What is the effect of addition of poles on Root locus? **03**

(b) $G(s)H(S) = \frac{1}{(s+1)}$. Decide the stability using Nyquist plot. **04**

(c) Sketch the Root locus of a unity feedback control system with $G(s) = \frac{k}{s(s+3)(s+5)}$ and determine the value of k for marginal stability. **07**

OR

Q.5 **(a)** Write the State model of n^{th} order of system. **03**

(b) Draw polar plot of $G(S)H(S) = \frac{1}{(S+3)(S+8)}$. **04**

(c) Draw the asymptotic Bode plots for the feedback control system having transfer function $G(S)H(S) = \frac{k}{S\left(1+\frac{s}{4}\right)\left(1+\frac{s}{40}\right)}$. Determine the value of k for Gain margin = 20dB and Phase margin 30°. **07**

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