Enrollment No: _____ Exam Seat No:_____

C. U. SHAH UNIVERSITY

Winter Examination-2019

Subject Name: Linear Control Theory

Subject Code: 4TE05LCT1 **Branch: B.Tech (Electrical)**

Semester : 5 **Date : 19/11/2019** **Time : 10:30 To 01:30** **Marks : 70**

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) Which notation represents the feedback path in closed loop system representation?
(a) b(t) (b) c(t) (c) e(t) (d) r(t)

b) The output signal is fed back at the input side from the _____point
(a) Summing (b) Differential (c) Take-off (d) All of the above

c) In a signal flow graph, nodes are represented by small _____
(a)Circles (b)Squares (c)Arrows (d) Pointers

d) Which condition is used to verify the existence of a particular point on the root locus?
(a) Amplitude (b) Frequency (c) Magnitude (d) Angle

e) Basically, poles of transfer function are the Laplace transform variable values which causes the transfer function to become _____
(a)Zero (b) Unity (c) Infinite (d)Average value

f) Which unit is adopted for magnitude measurement in Bode plots?
(a) Degree (b) Decimal (c) Decibel (d) Deviation

g) Which type of node comprises incoming as well as outgoing branches?
(a) Source node (b) Sink node (c) Chain node (d) Main node

h) State space analysis is applicable even if the initial conditions are _____.
(a) zero (b) non-zero
(c) equal (d) not equal

i) The characteristic equation of a feedback control is $2s4 + s3 + 3s2 + 5s + 10 = 0$. The no of roots in the right half of the s-plane is
(a)2 (b)3 (c)4 (d)0

j) What is the value of parabolic input in Laplace domain?
(a) 1 (b) A/s (c) A/s^2 (d) A/s^3

k) Define : sink node

l) Define : source node

m) Define : self loop

n) Define : transfer function

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

(a) Explain about liquid level system giving suitable example. Obtain its transfer function **(07)**

(b) Using the block diagram reduction techniques, find the closed loop transfer Function of the system whose block diagram is given in Fig.1. **(07)**

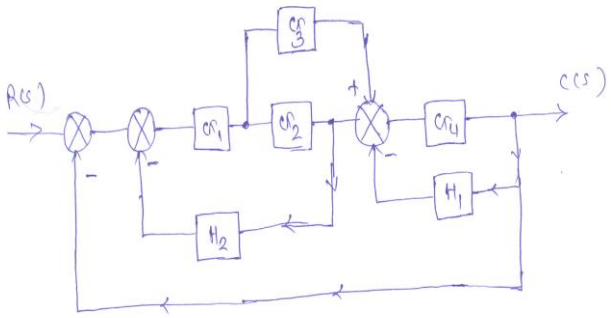

Fig.1

Q-3 **Attempt all questions** **(14)**

(a) Obtain overall transfer function C/R of the system whose signal flow graph shown in Fig.2 **(07)**

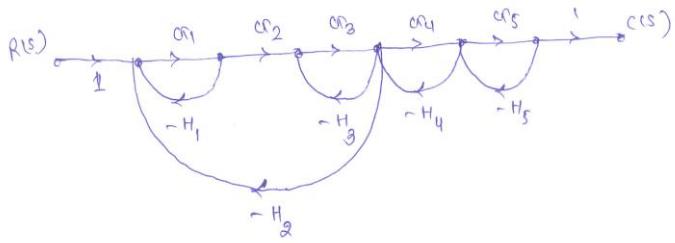

Fig. 2

(b) Explain the difference between Open loop and Close loop control system with examples. Compare their merits and demerits. **(07)**

Q-4 **Attempt all questions** **(14)**

(a) Define the Term **(07)**

i) Phase Margin ii) Gain Margin iii) Steady state response iv) Steady state error v) Delay time vi) Rise time vii) Peak Time.

(b) Write the equilibrium equation for the mechanical system and obtain the F-I analogous system. Fig.3 **(07)**

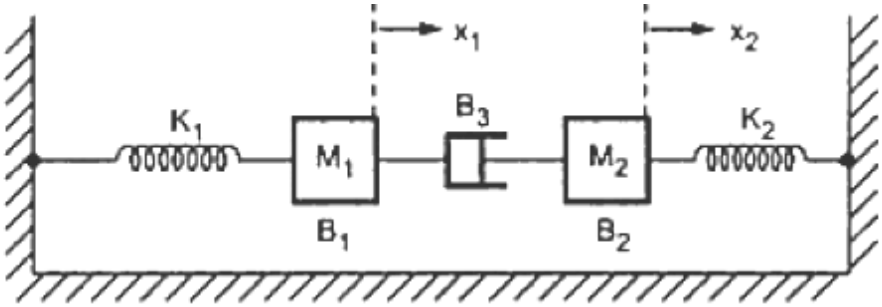

Fig .3

Q-5		**Attempt all questions**	**(14)**
	(a)	What are the Advantages of Bode Plots?	**(07)**
	(b)	$s^6+2s^5+8s^4+12s^3+20s^2+16s+16 = 0$ check the stability of the given characteristic equation using Routh's method.	**(07)**
Q-6		**Attempt all questions**	**(14)**
	(a)	A Single input single output system is given as	**(07)**

$$x(t) = \begin{vmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{vmatrix} x(t) + \begin{vmatrix} 1 \\ 1 \\ 0 \end{vmatrix} u \quad \& \quad y=[\,1\ 0\ 2\,]\, x(t)$$

Test for controllability and observability.

	(b)	Derive the expression for static error coefficient.	**(07)**
Q-7		**Attempt all questions**	**(14)**
	(a)	For a unity feedback system, $G(s) = \frac{K}{s(s+2)(s+10)}$ .Find the Marginal Value of 'K' for which system will be marginally stable, using bode plot.	**(07)**
	(b)	Explain standard test input signals.	**(07)**
Q-8		**Attempt all questions**	**(14)**
	(a)	What are Advantages of Nyquist Plots?	**(07)**
	(b)	Sketch the Root Locus for the system having G(S) H(S) $= \frac{K(s+4)}{s(s^2+2s+2)}$.	**(07)**