C.U.SHAH UNIVERSITY
Winter Examination-2018

Subject Name: Linear Control Theory

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

Semester: 5   **Date: 30/11/2018**   **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 of the following is an open loop control system?   **(01)**
(a)Field controlled D.C. motor (b) Ward leonard system
(c) Metadyne   (d) Stroboscope

b) The capacitance, in force current analogy, is analogous to   **(01)**
(a) momentum   (b) velocity
(c) displacement   (d) mass

c) In force voltage analogy, velocity is analogous to   **(01)**
(a) current   (b) charge
(c) inductance   (d) capacitance

d) The impulse function is a derivative of __ function.   **(01)**
(a) parabolic   (b) step
(c) ramp   (d) linear

e) State space analysis is applicable even if the initial conditions are _____.   **(01)**
(a) zero   (b) non-zero
(c) equal   (d) not equal

f) At summing point, more than one signal can be added or _____   **(01)**
(a) Subtracted (b) Multiplied (c)Both a & b (d) None of the above

g) The characteristic equation of a feedback control is $2s^4 + s^3 + 3s^2 + 5s + 10 = 0$.   **(01)**
The no of roots in the right half of the s-plane is
(a)2 (b)3 (c)4 (d)0

h) Basically, poles of transfer function are the Laplace transform variable values   **(01)**
whichcauses the transfer function to become _____
(a)Zero (b) Unity (c) Infinite (d)Average value

i) Which type of node comprises incoming as well as outgoing branches?   **(01)**
(a) Source node (b) Sink node (c) Chain node (d) Main node

j) The type 1 system has_____at the origin.   **(01)**
(a)no pole   (b)net pole   (c)Simple pole   (d) two pole

k) Define : sink node   **(01)**

l) Define : non-touching loops   **(01)**

m)	Define : source node	**(01)**
n)	Define : transfer function	**(01)**

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

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

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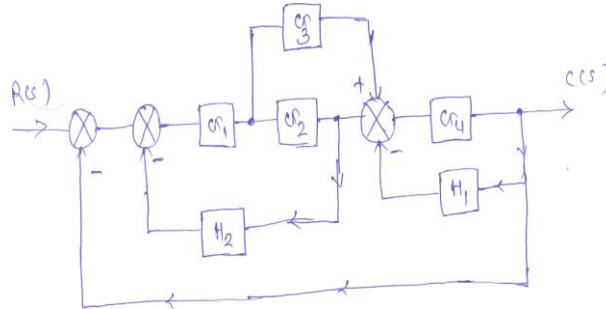

Fig.1

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

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

(a) What is analogus system? Establish forcevoltage and force current analogy. **(07)**

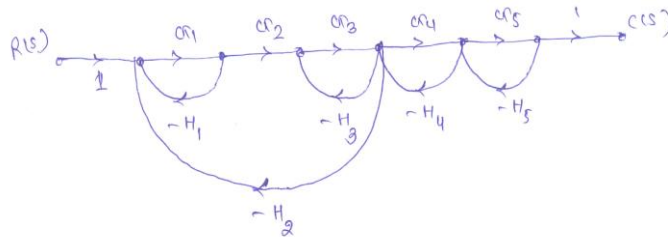**(b)** Obtain overall transfer function C/R of the system whose signal flow graph **(07)** shown in Fig.2

Fig. 2

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

(a) Draw free body diagram and write the differential equation for the given **(07)** mechanical system. Fig 3.
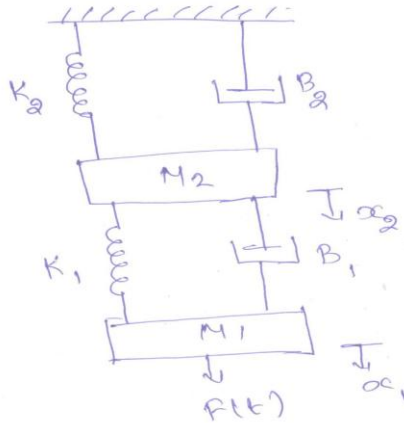
Fig 3

(b) Define the Term **(07)**
(i)Time Response (ii)Transient Response (iii)Steady state response (iv)steady state error (v) Delay time (vi) Rise time (vii) Peak Time

Q-5 **Attempt all questions** **(14)**
(a) A Single input single output system is given as **(07)**

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

Test for controllability and observability.
(b) Derive the transfer function of simple Liquid level system. **(07)**

Q-6 **Attempt all questions** **(14)**
(a) Explain standard test input signals. **(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-7 **Attempt all questions** **(14)**
(a) Sketch the Root Locus for the system having G(S) H(S) $=\frac{K(s+4)}{s(\ s^2+2s+2)}$. **(10)**
(b) What are Advantages of Bode Plots? **(04)**

Q-8 **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. **(10)**
(b) What are Advantages of Nyquist Plots? **(04)**