Printed pages:4 **EIC501**

(Following paper code and roll No. to be filled in your answer book)

Paper code: 132502 Roll No. | | | | | | | | | | |

B TECH
(SEM V) THEORY EXAMINATION 2014-15
CONTROL SYSTEM-I

TIME: 3 Hours **Total Marks: 100**

Note: Attempt questions from each Section as per instructions.

SECTION-A

1. Attempt ALL parts. **2*10=20**

a. Classify control Systems and give the merits and demerits of open loop control system & closed loop control system.

b. For the forward path, TF given by

$$G(s) = \frac{20\ (s+2)}{s\ (s+3)(s+4)}$$. Find Error coefficients.

c. Explain the Incremental Encoder?

d. Find the breakaway points of

$$G(s)H(s)= \frac{K}{S\ s+4\ (s^2+4s+20)}$$

e. Find the Gain margin of $G(s)= \frac{80}{s\ s+2\ (s+20)}$

f. Under damped systems are most preferred system. Explain why?

g. How transfer function can be obtained from state equations. Explain.

h. A system has a transfer function $\frac{C}{R} = \frac{20}{s+10}$ .Determine its Unit Impulse Response.

i. Explain Mason Gain Formula briefly.

j. Find the phase system $G(s)H(s)= \frac{e^{-0.2s}}{s(s+1)}$ for $\omega=5$.

SECTION-B

2. Attempt any SIX parts. **5*6=30**

a. Consider the following equation, which may be the characteristic equation of linear control systems. Find the system is stable or unstable.
$S^5+4s^4+8s^3+8s^2+7s+4=0$

b. Determine the transfer function C/R of the system shown in Fig.1 using block diagram reduction techniques.

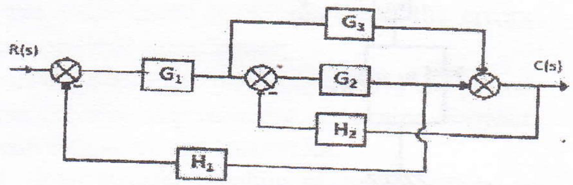


Fig1

c. For the system $G(s)H(s) = k(1+s)^2/ s^3$,find the range of 'k' for the system to be stable.

d. Derive the peak in frequency response (M_r) and ω_r for Second Order Control System?

e. Consider the differential equation given as :- $\dddot{y} + 6\ddot{y} + 11\dot{y} + 6y = \dddot{u} + 8\ddot{u} + 17\dot{u} + 8u$.Draw Block diagram using parallel decomposition.

f. Explain the nature of response terms contributed by various types of roots and conclude about the BIBO stability. Give the difference between :-
(i). Absolute and relative stability.
(ii) BIBO and Asymptotic stability for a continuous data system.

g. Determine the type and order of the unity feedback control systems whose open-loop transfer functions are
$G(S)=K / S(S^2+4S+200)$
Find also the static error coefficients and the errors for unit step and unit ramp inouts.

SECTION-C

3. Attempt any two parts: **10*2=20**

a. Draw the equivalent mechanical system of the given system(fig 2).Hence,write the set of equilibrium equatons for it and obtain electrical analogus circuits using F-V analogy

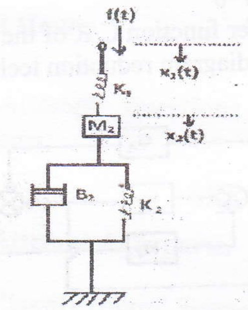


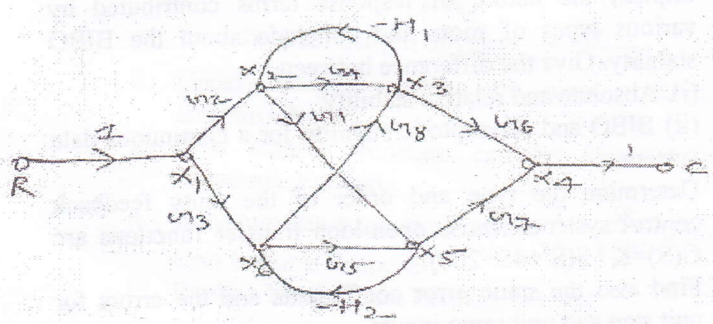
Fig 2

b. Sketch the Nyquist plot for the system having

$G(s)H(s) = \frac{1+4s}{s\ 1+s\ 1+2s}$

Using the Nyqist criterion,determine whether the closed loop system having the above open loop transfer function is stable or not.

c. Find out the transfer function C/R for the signal flow graph shown in figure:-



4. Attempt any three parts **10*3=30**

a. Draw the Bode Plot for the transfer function
   $G(S)= 36 (1+0.2 s)/ s^2(1+0.05s)(1+0.01s)$
   From the bode plot determine
   a) Phase crossover frequency
   b) Gain crossover frequency
   c) Gain Margin
   d) Phase Margin

b. Determine the type and order of the unity feedback control systems whose open-loop transfer functions are

   a) $G(S)=K / S(S^2+4S+200)$

   Find also the static error coefficients and the errors for unit step and unit ramp inputs.

c. A Second –order system has overshoot of 50% and period of oscillation 0.2 s in step response .determine resonant peak, resonant frequency and bandwidth.

d. The closed –loop transfer function of certain second – order unity feedback control systems are given below. Determine the type of damping in the systems:

   i. $C(S)/R(S) = 8/S^2+3S+8$

   ii. $C(S)/R(S) = 4/S^2+16$