Roll No.										

Paper Code: IC-501

B.Tech

(SEM V)ODD SEMESTER EXAMINATION 2016-17

Control Systems-I

[Time-3 Hrs.] **[Max. Marks-100]**

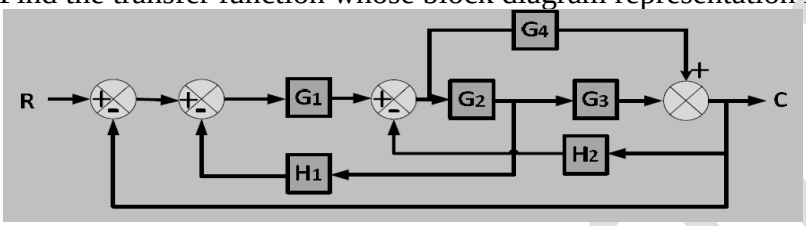
Note-Attempt All Question .All Questions Carry equal marks.

1. Attempt any **FOUR** questions of following:- **(5x4 =20)**

(a) Discuss the effect of feedback on stability, noise and overall gain of the system.

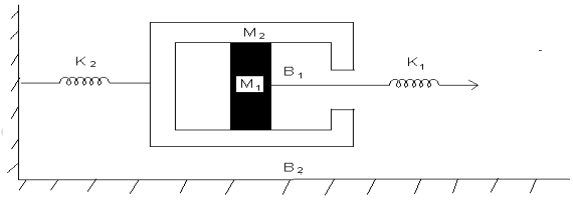
(b) What do you mean by feedback control system? Distinguish between the open loop system and closed loop system.

(c) Find the transfer function whose block diagram representation is shown in below fig:

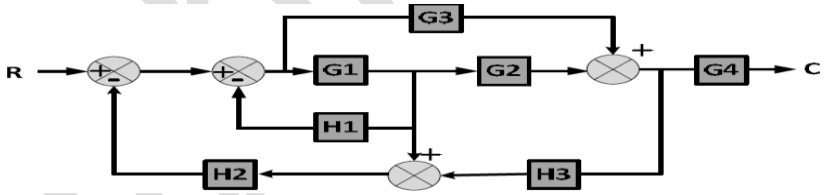


(d) Draw the electrical analogous circuit using force voltage (f-v) and force current analogy for the mechanical system shown in the below fig.

i.



(e) Determine C/R using Mason's Gain formula for the system shown in below fig.



(f) Find the transfer function of armature control DC Motor.

2. Attempt any **TWO** questions of following:- **(10X2 =20)**

(a) Realize State Model by cascade Decomposition and parallel decomposition of the following transfer function $\frac{Z(s)}{V(s)} = \frac{s(s+2)}{(s+4)(s+5)(s+1)}$

(b) Consider the system $\dot{X} = \begin{vmatrix} 0 & 1 \\ -2 & -3 \end{vmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} U$, $X(0) = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$, $Y = [1 \quad 0]\, X$

Obtain the time response of the following system. Where U is the unit step occurring at t=0.

(c) Define state variables and explain its importance and use in the mathematical modeling of the system. What are the advantages of state space approach? Also define the state transition matrix and discuss its properties.

3. Attempt any **FOUR** questions of following:- **(5x4 =20)**

(a) A unity feedback system has G(s) =$\frac{40(s+2)}{s(s+1)(s+4)}$. Determine
   (i) Type of system
   (ii) All error coefficients and error for ramp input with magnitude

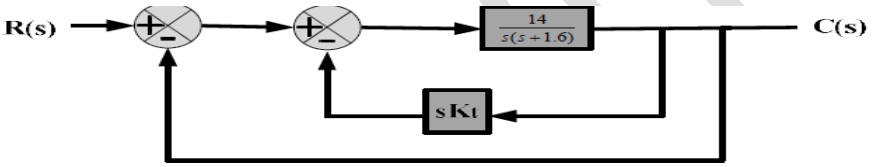
(b) Define the following and also indicate on the transient response curve of second order system.
   (i) Rise time
   (ii) Delay time
   (iii) Peak overshoot
   (iv) Steady state error Time constant

(c) Derive the expression for the peak time (t_p) and rise time (t_r) for the Second order system.

(d) An open loop transfer function of a unity feedback system is given by. G(s) =$\frac{K}{s(1+sT)}$ Where K and T are positive constant. By what factor should be the amplifier gain K be reduced so that the peak overshoot of unit step response of the system reduced from 80% to 30%.

(e) Find the dynamic error coefficients of the unity feedback system whose forward path transfer function $G(s) = \frac{10}{s\,(s+1)}$. Find the steady state error to the input r(t) = Po + P_1 t + P_2 t^2 .

(f) The system shown in the fig. uses a rate feedback controller. Determine the tachometer constant K_t so as to obtain the damping ratio 0.5. Calculate the corresponding W_d, t_p, t_s and M_p.



4. Attempt any **TWO** questions of following:- **(10X2 =20)**

(a) State Routh's Stability Criterion. Also find the region in which following closed loop system is stable

G(s)H(s) = $\frac{K(s+1)}{s(1+sT)(1+3s)}$

(b) Discuss the concept of stability for Bounded input, Bounded output continuous Data system. Also explain the concept of relative stability.

(c) The open loop transfer function of a control system is given by

$$G(s)H(s) = \frac{K}{s\,(s+6)(s^2+\,4s+13)}$$

Sketch the root locus and determine the stability condition.

5. Attempt any **TWO** questions of following:- **(10X2 =20)**

(a) Establish the correlation between the frequency domain response and time domain response.

(b) Sketch the Nyquist plot for the system with the open loop transfer function :

i. G(s) H(s) = $\frac{k(\,1+0.5s)(s+1)}{(1+10s)(s-1)}$

(c) The open loop transfer function of a system is, G(s) = $\frac{k}{s(1+0.5s)(1+0.2s)}$ Sketch bode plot and find gain margin, phase margin and also determine the stability condition.