Sub Code: NIC501

Paper Id: 132514 Roll No:

B.TECH
(SEM VII) THEORY EXAMINATION 2019-20
CONTROL SYSTEM I

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

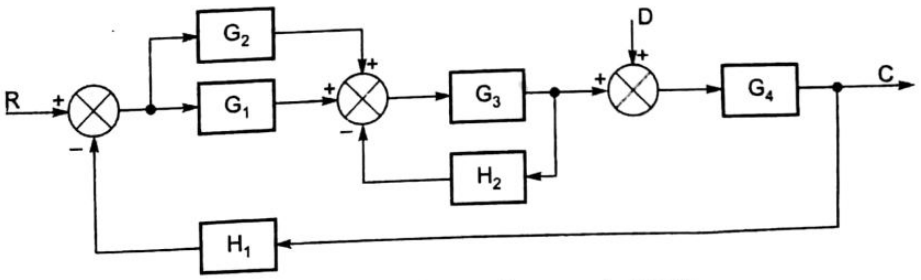
SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a.	Define Mason's gain formula.
b.	Define Loop & Non-touching loop.
c.	Explain controllability related to control system.
d.	What are the different methods for determining Absolute & Relative Stability?
e.	What is resonant peak, resonant frequency of prototype second order system?
f.	Write down the force current analogy in linear and rotational motion.
g.	Write down the expression for Gain Margin & Phase Margin.
h.	Sketch the output curve versus time for second order **over-damped** system subjected to unit step input.
i.	Explain the effect of adding a pole to the forward path transfer function.
j.	Define observability related to control system.

SECTION B

2. Attempt any *three* of the following: 10x3=30

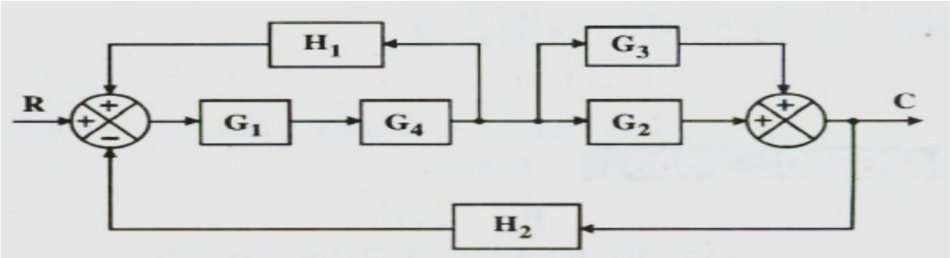
a.	Determine the ratio C/R, C/D and the total output for the system whose block diagram is given as 
b.	Determine the static error coefficients and also determine the value of K to limit the steady state error to 20 units due to input. $r(t)=1+10t+20t^2$.
c.	The open loop transfer function of a system is G(s)H(s) = k(s+1)(s^3 +bs^2 +3s +1). Determine the values of **K and b** so that system will oscillate at frequency of 2 rad/sec by using **R-H criteria**.
d.	A second order system has overshoot of 50% and period of oscillation 0.2 second in step response. Determine resonant peak, resonant frequency and bandwidth.
e.	For a unity feedback control system the open loop transfer function G(S) = 10(S+2)/ S^2(S+1). Find the **steady state error** when the input is R(S) =2/S +4/S^2.

SECTION C

3. Attempt any *one* part of the following: 10x1=10

a.	Write four properties of state transition matrix $\varphi(t)$ with their proof.
b.	Determine the transfer function C/R of the system show in figure using block

Paper Id: 132514 Roll No:

	diagram reduction technique. 

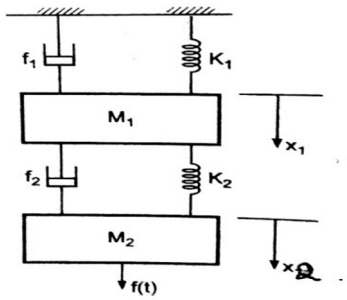
4. Attempt any *one* part of the following: 10x1=10

a.	Sketch Nyquist plot for Determine then range of K for which system is stable.	$GH=\frac{K(1+0.5s)(s+1)}{(1+10s)(s-1)}$
b.	For unity feedback system Draw bode plot. Find **K** when phase margin = 30°.	$G(s)=\frac{k}{s(s+4)(s+10)}$

5. Attempt any *one* part of the following: 10x1=10

a.	Determine the Transfer function Y(S)/U(S) Use given matrices.	$A=\begin{bmatrix}1 & 3\\ -2 & -3\end{bmatrix}$, $B=\begin{bmatrix}0\\ 3\end{bmatrix}$, $C=[1 \quad 0]$, $D=1$
b.	Derive the expressions and draw output the response of second order under-damped system for unit step input.	

6. Attempt any *one* part of the following: 10x1=10

a.	What are the necessary & sufficient conditions of R-H criterion? Also explain some limitation of R-H criterion.	
b.	Draw the mechanical circuit diagram of given mechanical system.	

7. Attempt any *one* part of the following: 10x1=10

a.	Determine the range of k such that the characteristics equation $1+GH=S^3+3(K+1)S^2+(7K+5)S+4K+7=0$ has roots more negative than S = -1.	
b.	Find the Range of K for the system to be (i) stable (ii) unstable (iii) Marginally stable by R-H Criterion. given open loop transfer function:	$GH=\frac{k}{s(s+3)(s+5)}$.