Paper Id: | 132511 | **Roll No:** | | | | | | | | | | | | | |

B.TECH
(SEM-V) 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.	Write down two differences between open loop and close loop control system.
b.	What are feedback and its effect in close loop system?
c.	Define transfer function.
d.	Define Gain Margin & Phase Margin.
e.	Sketch the output curve versus time for second order **over-damped** system subjected to unit step input.
f.	Explain the effect of adding a pole to the forward path transfer function.
g.	Define observability related to control system.
h.	Define Mason's gain formula.
i.	Define Loop & Non-touching loop.
j.	Explain controllability related to control system.

SECTION B

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

a.	Obtain signal flow graph representation for a system whose block diagram is given as and also find a) Forward path b) Individual loops c) Path factor d) non-touching loops e) Determine the graph determinant.
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.	Derive the expressions and draw the response of second order under-damped system for unit step input.
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 $R(S) =2/S +4/S^2$.

Paper Id: | 132511 | **Roll No:** [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

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.	Find characteristics equation and poles of LTI system with state model matrix $$A= \begin{bmatrix} 0 & 1 \\ -8 & -6 \end{bmatrix}.$$

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

a.	Determine the transfer function C/R of the system show in figure using block diagram reduction technique.
b.	For unity feedback system $$G(s) = \frac{k}{s(s+4)(s+10)}$$ Draw bode plot. Find **K** when phase margin = 30°.

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

| a.	Consider SISO control system having overall transfer function $$T(s)= \frac{s^2+4s+4}{s^3+5s^2+4s}.$$ Represent state model in terms of Canonical variable with block diagram and obtain **matrices A,B,C.**
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.	Determine the transfer function Y2(S)/F(S) of the system shown in fig:

Paper Id: 132511   **Roll No:** [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]
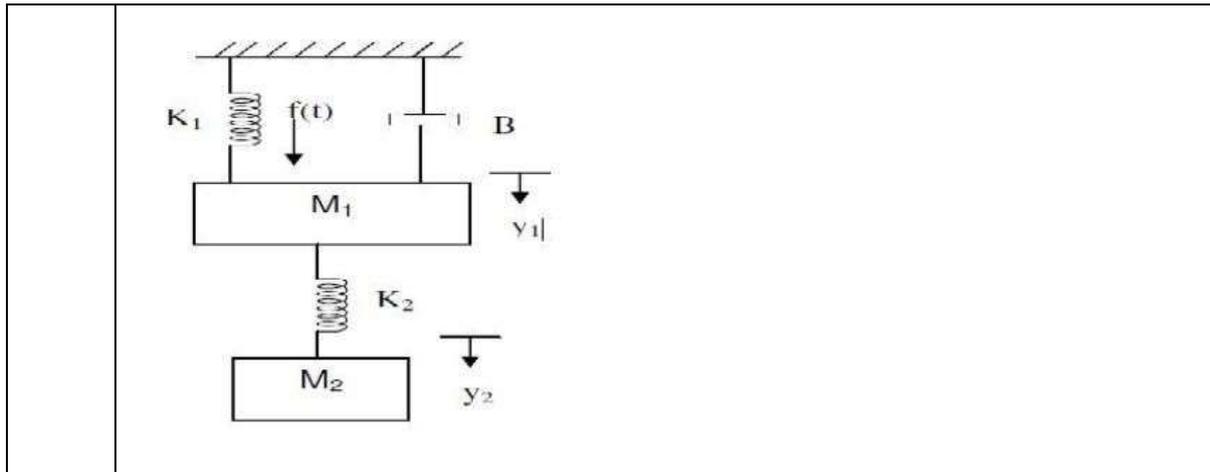
7. **Attempt any *one* part of the following:**   **10x1=10**

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: $$GH=\frac{k}{s(s+3)(s+5)}.$$