PAPER ID-410833

Roll No: | | | | | | | | | | | | | |

B.TECH
(SEM V) THEORY EXAMINATION 2021-22
CONTROL SYSTEM

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

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

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

a. Draw the block diagram, which represent a driver driving a car.
b. Define: Self loop & non-touching loop in signal flow graph by suitable example.
c. What do you mean by Settling Time, write expression for 2nd order system?
d. The OLTF of a unity feedback system is G(s) = 1/s(s+1)(s+4) find the steady state error **(ess)** due to a unit step.
e. What are the limitations of Routh Hurwitz criterion?
f. State Absolute Stability & Relative Stability.
g. Draw the polar plot G(s)=1/(s+ 2)
h. Write advantages of Bode Plot.
i. Find the eigenvectors of the matrix

$$A = \begin{bmatrix} -3 & 1 \\ 1 & -3 \end{bmatrix}$$

j. Why compensators are used in control system, what is effect of lag compensator?

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. Write down various rules involve in Block Diagram Reduction method.
b. The unity feedback system is characterized by an open loop transfer function is G(S) = K/s(s+20).Determine the gain K, so that the system will have a damping ratio of 0.6. For this value of K, determine unit step response, time domain specifications: settling time (2% criterion), Peak overshoot, Rise time,Peak time, Delay time for a unit-step input.
c. Explain the effect of addition of pole & zero on Root Locus & time domain specifications.
d. Sketch the polar plot of the following function, also determine Gain Margin, Phase Margin, H(s) =1.

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

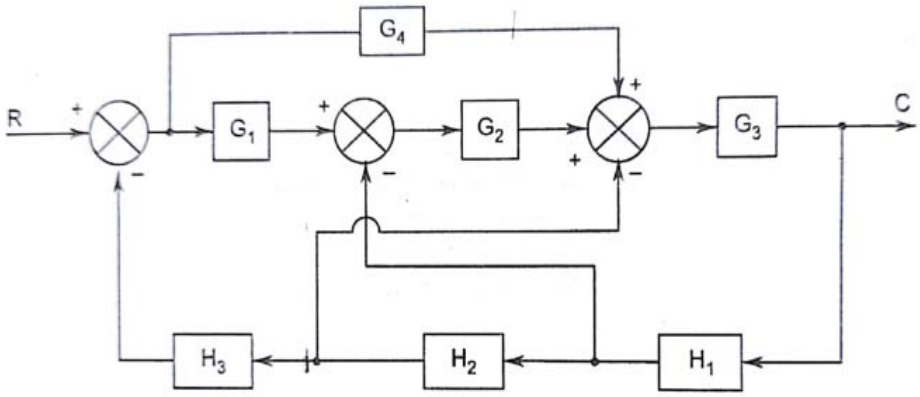
e. State properties of State Transition Matrix (STM) , find out State Transition Matrix for

$$A = \begin{bmatrix} 0 & 1 \\ -8 & -6 \end{bmatrix}$$

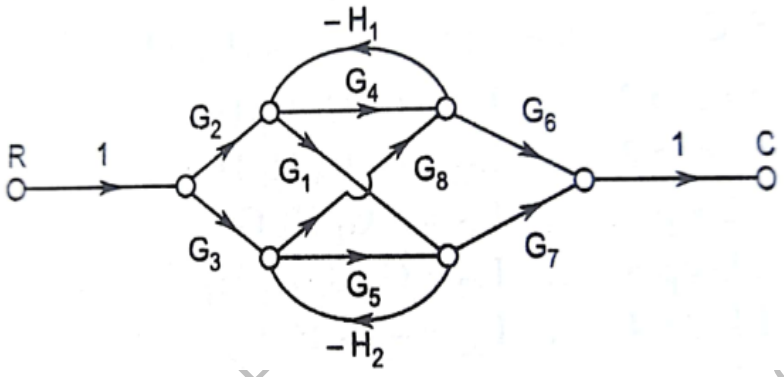
SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Find out C/R by using Block Diagram Reduction method.



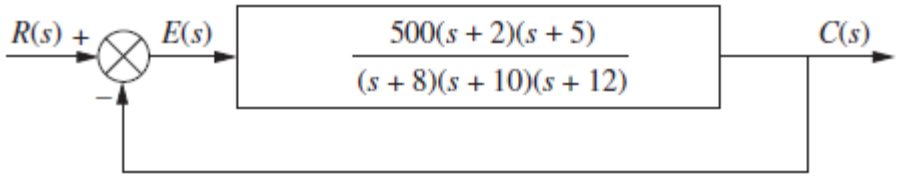
(b) Find the overall gain of the system whose signal flow graph is shown below.



4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Compare Proportional (P)control action with Integral (I)control action & Prove That By Using Proportional Integral PI controller Steady State error Become zero in a system.

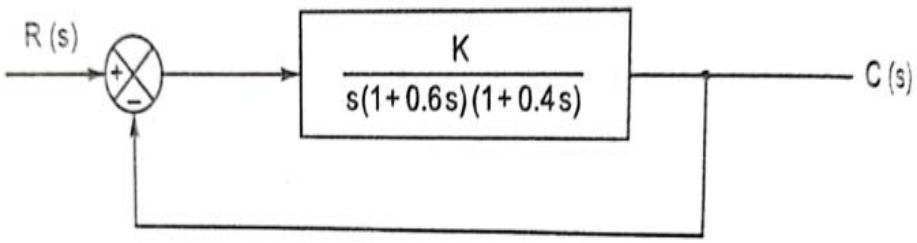
(b) Find out various error coefficients: Kp, Kv Ka & steady state error for standard step, ramp, and parabolic inputs for system shown below:



(a)

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain the effect of pole location on stability of a system by suitable diagram, Determine range of K & frequency of sustained oscillations for a given unity feedback system.



(b) Sketch the root locus of the system whose open loop transfer function is G(S)= K / s(s+2)(s+5).Find the value of K so that system is marginal stable , find out damped frequency of oscillation, also find K when the damping ratio of the closed loop system is 0.5.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Sketch Bode plot for the following transfer function and determine the gain cross over frequency & phase cross over frequency, comment on stability.
G(s) H(s)= 10 / s (1+s)(1+0.002s)

(b) Draw the complete Nyquist plot for a unity feedback system having the open loop Function, from this plot obtain all the information regarding stability.
G(s) H(s) = k/ s(s+3)(s+5)

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Design a lead compensator for a system whose open loop transfer function is G(s)H(s) =4/ s(s+2)
It will fulfill following requirement-
(i)Static velocity error constant =20sec^{-1} (ii) P.M at least 50º (iii)G.M.at least 10db

(b) Determine The State controllability & Observiability of the system described

$$\dot{x} = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 3 \\ -7 & 5 & 9 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} u \text{ and}$$

$$y = \begin{bmatrix} 5 & 2 & 7 \end{bmatrix} x$$

as: