



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

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

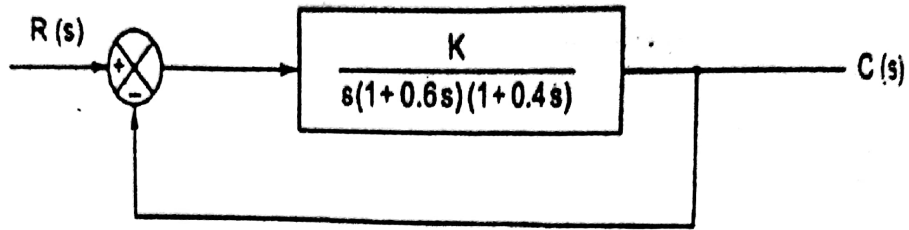
- e. State properties of State Transition Matrix (STM) , find out State Transition Matrix for

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



Roll No:

--	--	--	--	--	--	--	--	--	--	--	--



- (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 50° (iii) G.M. at least 10db
- (b) Determine The State controllability & Observability of the system described

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

$$y = [5 \quad 2 \quad 7] x$$

as:

108-