

					Sub	ject	Co	de:	KEE	502
Roll No:	A Day									

## 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.

 $2 \times 10 = 20$ 

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- 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 2<sup>nd</sup> 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

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

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

## SECTION B

2. Attempt any three of the following:

 $10 \times 3 = 30$ 

- 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% orderion), 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

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



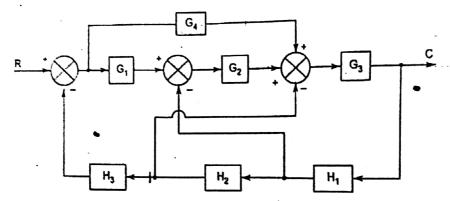
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## **SECTION C**

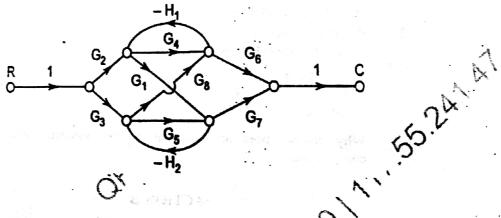
3. Attempt any one part of the following:

 $10 \times 1 = 10$ 

(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.

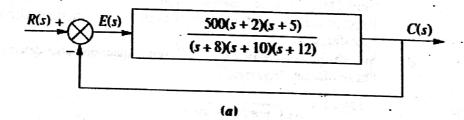


4. Attempt any one part of the following:

 $10 \times 1 = 10$ 

(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, Ky Ka & steady state error for standard step, ramp, and parabolic inputs for system shown below:



5. Attempt any one part of the following:

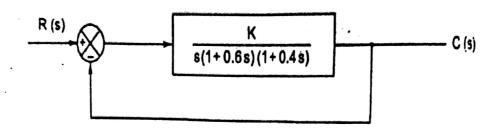
 $10 \times 1 = 10$ 

(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.



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- (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:

 $10 \times 1 = 10$ 

- (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 followings:

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<sup>-1</sup> (ii) P.M at least 50% (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: