

Code No: R1622024

R16

SET - 1

II B. Tech II Semester Supplementary Examinations, November - 2018

CONTROL SYSTEMS

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)

2. Answer **ALL** the question in **Part-A**

3. Answer any **FOUR** Questions from **Part-B**

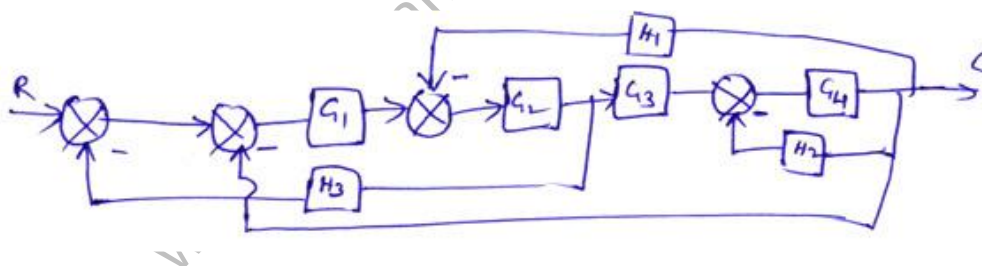
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**PART -A**

1. a) What are the merits and demerits of block diagram reduction process over signal flow graph.
- b) What are the effect of adding poles and zeros to transfer function
- c) State the necessary and sufficient conditions R-H criterion on stability
- d) What are the merits of frequency response analysis
- e) Derive the transfer function of phase lag compensator
- f) What is meant by state of the system

**PART -B**

2. a) Explain the effect of feedback system
- b) A block diagram of a control system is shown in below figure. Draw the signal flow graph and determine the overall transfer function by using Masons gain formula.



3. a) Define the steady state error and error constants with respect to unit step, unit velocity and unit acceleration inputs. How can the steady state error be reduced.
- b) What is meant by PID control State the effect of PID controller on the system performance

4. For a unity feedback system, the open loop transfer function is

$$G(s) = \frac{k}{s(s+1)(s^2+4s+13)}$$

Draw the root-locus and determine the range of K for the system to be stable

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5. Sketch the bode plot of the transfer function

$$G(s) = \frac{15(1 + 0.2s)}{s^2(s + 2)(s + 5)}$$

Determine the following

- (i) gain cross over frequency, (ii) phase cross over frequency,  
 (iii) gain margin and (iv) phase margin

Comment on the stability of the system

6. The open loop transfer function of the uncompensated system is

$$G(s)H(s) = \frac{10}{s(s + 1)}$$

Design a suitable lag compensator for the system so that the static velocity error constant is  $20 \text{ sec}^{-1}$ , the phase margin is atleast  $55^\circ$  and the gain margin is atleast 12dB.

7. a) What is meant by phase variables? What are the merits and demerits of representing the system in state variable form  
 b) A system is described by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Check the controllable and observability of the system