

Code No: RT22026

R13
SET - 1
II B. Tech II Semester Supplementary Examinations, April-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**)

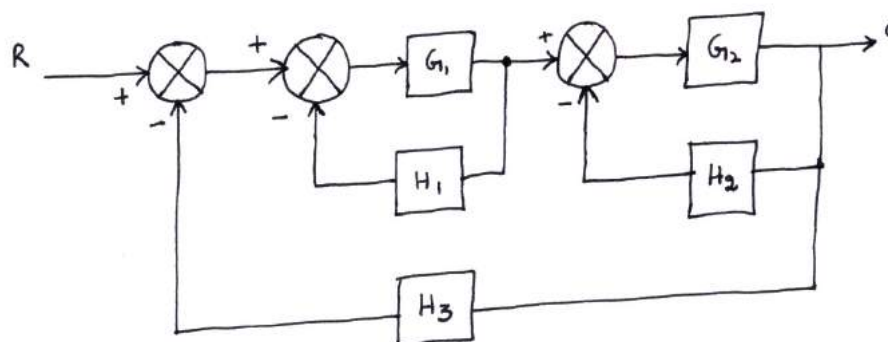
 2. Answer **ALL** the question in **Part-A**

 3. Answer any **THREE** Questions from **Part-B**
PART-A

1. a) What do you mean by mechanical translational systems (3M)
- b) What is the use of Mason's gain formula? (3M)
- c) Define steady state response and steady state error. (3M)
- d) What conclusion can be made if there is a row of all zeros in the Routh array? (2M)
- e) Define resonant frequency. (2M)
- f) What is the difference polar plot and Nyquist plot. (3M)
- g) Why frequency domain compensation is normally carried out using the Bode plots? (3M)
- h) What are the two conditions to be satisfied by the state variables? (3M)

PART-B

2. a) List the properties of signal flow graphs. (6M)
- b) Obtain the transfer function of the following by using block diagram reduction technique. (10M)



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3. a) Derive an expression for the time response of a second order system excited by a unit step input (8M)
- b) A closed loop system has two complex conjugate poles at $s_1, s_2 = -2 \pm j1$. (8M)
 Determine the form of transfer function and values of natural frequency of oscillations of the system (ω_n), Peak time (T_p), Rise time (T_r), Settling time (T_s) and Peak Overshoot(M_p) assuming standard second order system.
4. a) State and explain the Routh stability criterion (8M)
- b) Determine the stability of the system having characteristic equation (8M)
 $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$
5. Sketch the Bode plot for the following transfer function and find the system gain K for the gain cross over frequency to be 10 rad/s. (16M)

$$G(s) = \frac{K s^2}{(1+s)(1+0.2s)(1+0.02s)}$$

6. a) List the limitations of lag, lead, lag-lead compensators. (6M)
- b) Explain the realization of basic lag compensator using a Bode plot. (10M)
7. Given the system (16M)
 $\dot{x}(t) = A x(t) + B u(t),$
 $Y(t) = C x(t)$

$$\text{Where } A = \begin{bmatrix} -1 & 1 & 0 \\ 0 & -1 & 1 \\ 0 & 0 & -1 \end{bmatrix}, \quad B = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}, \quad C = [1 \ 0 \ 1]$$

Determine the state controllability, output controllability and observability of the system