

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER- III(NEW) EXAMINATION – WINTER 2022****Subject Code:3131101****Date:22-02-2023****Subject Name:Control Systems****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1** (a) Compare closed loop and open loop system. **03**
 (b) Discuss Force-Current (F-I) analogous system with analogous quantity. **04**
 (c) Define steady state error and derive the expressions for static error coefficients corresponding to step, ramp and parabolic inputs respectively. **07**

- Q.2** (a) List properties of the transfer function. **03**
 (b) Discuss unit step response of first order system. **04**
 (c) Draw the Nyquist plot for $G(s) = 1/s(s+1)$ and comment on system stability. **07**

OR

- (c) For the signal flow graph shown in Fig. 1, using Mason's gain formula determine the overall transmission C/R. **07**

- Q.3** (a) What is polar plot? **03**
 (b) Using Routh's criterion check the stability of a system whose characteristic equation is given by $s^5 + 2s^4 + 2s^3 + 4s^2 + 11s + 10 = 0$ **04**
 (c) Obtain the state transition matrix for the state model whose system matrix is given by $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$. **07**

OR

- Q.3** (a) Describe in brief about PD controller. **03**
 (b) List advantages of state variable analysis. **04**
 (c) Draw the bode plot for a unity feedback system having, **07**

$$G(s) = \frac{100}{s(1+0.5s)(1+0.1s)}$$

- Q.4** (a) Discuss following transient response specification: Delay Time, Peak overshoot, Settling Time **03**
 (b) Describe critical rules of block diagram reduction techniques. **04**
 (c) What is Root locus? Sketch the Root locus plot for the unity feedback system having open loop transfer function, **07**

$$G(s) = \frac{K}{s(s+3)(s^2+3s+4.5)}$$

OR

- Q.4** (a) Define: Gain margin, phase margin, absolute stability **03**
 (b) Describe any four block diagram reduction techniques. **04**
 (c) Discuss steps to design a Lag Compensator using Bode plot method. **07**

- Q.5** (a) Write a note on PID controller. **03**
 (b) Derive the expression for peak time T_p for a second order control system subjected to a unit step input. **04**
 (c) Write a short note on state space representation of a control system. **07**

OR

- Q.5 (a) Discuss the effect of feedback on sensitivity. 03
(b) Explain the Lead Compensator with its transfer function. 04
(c) Derive the state variable equation $\dot{X} = AX + BU$ and $Y = CX + DU$. Also draw the state diagram 07

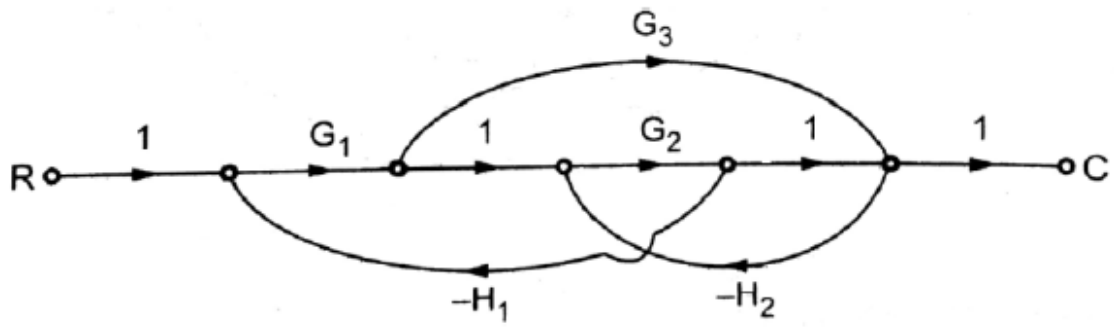


Fig. 1
