Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC-Semester –III (May-2012) Examination

Subject code: X30903

Subject Name: CONTROL THEORY

Date: 16/05/2012

Time: 02.30 pm – 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.**

Q.1 **(a)** Establish correlation between transfer function and state space equation. **07**

(b) Discuss basic principle for obtaining derivative control action. Explain effect of P and PD controller with suitable example. **07**

Q.2 **(a)** Discuss major advantages and disadvantages of open loop control system. Compare it with closed loop control systems. **07**

(b) For the system shown in Figure-1, obtain the closed loop transfer function Y(s)/X(s) by use of Mason's fain formula. **07**

OR

(b) For the system shown in Figure-2, obtain the closed loop transfer function Y(s)/U(s) by use of block diagram reduction technique. **07**

Q.3 **(a)** Discuss unit step response curve showing transient response specifications: delay time (t_d), rise time (t_r), peak time (t_p), maximum overshoot (M_p) and settling time (t_s). Discuss these specifications for the second order system. **07**

(b) Discuss steady state error in unity feedback control system. Explain static position, velocity and acceleration error constants. **07**

OR

Q.3 **(a)** Explain procedure to check system stability using Routh's stability criterion. Discuss special cases. **07**

(b) With appropriate example discuss effect of integral and derivative control actions on system performance. **07**

Q.4 **(a)** What is root locus? Discuss angle and magnitude conditions. For the feedback system with $G_{(s)} = \frac{k}{s(s+1)(s+2)}$, $H_{(s)} = 1$; find angle and magnitude conditions. **07**

(b) What is transportation lag? Obtain magnitude and angle conditions for the system with $G_{(s)} = \frac{ke^{-Ts}}{(s+1)}$, $H_{(s)} = 1$. **07**

OR

Q.4 **(a)** Discuss in brief, general rules for construction of root loci. **07**

(b) Explain conditionally stable systems with appropriate example. **07**

Q.5 **(a)** Draw Bode magnitude and phase diagram for; **07**

- Gain (K)
- Derivative and Integral factors $(j\omega)^{\pm 1}$
- First order factors $(1 + j\omega)^{\pm 1}$

(b) Discuss phase margin and gain margin of stable and unstable system with the help of (a) Bode diagrams and (b) Polar plots. **07**

OR

Q.5 **(a)** Discuss minimum phase and non minimum phase systems. Draw pole zero configuration and discuss phase angle characteristics of minimum phase and non minimum phase systems. **07**

(b) Sketch the polar plot for the transfer function $G_{(s)} = \frac{1}{s(\tau s+1)}$. **07**

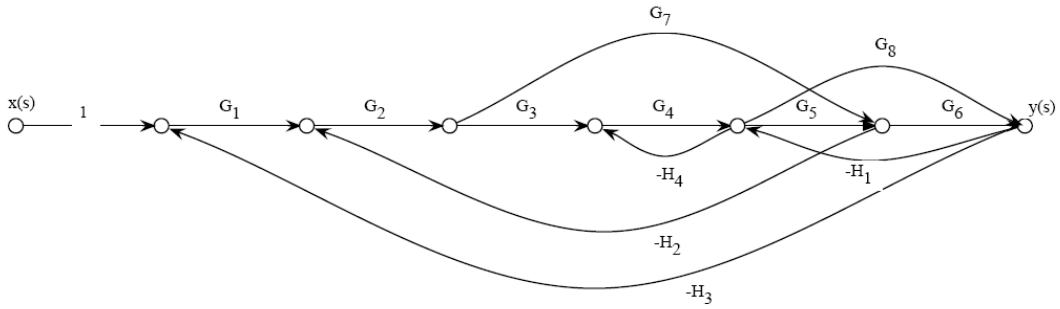

Figure-1 Block diagram representation for **Q. 2(b)**

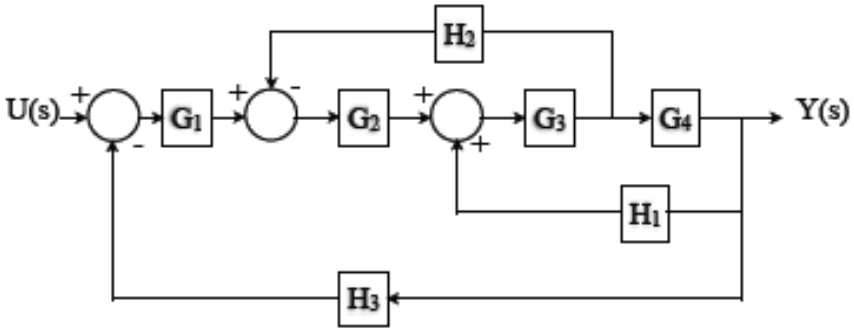

Figure-2 Block diagram representation for **Q. 2(b) OR**

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