Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–IV EXAMINATION – SUMMER 2016

Subject Code:X41102 **Date:30/05/2016**

Subject Name:Control Theory

Time:10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**

Q.1 **(a)** Differentiate open loop and closed loop control systems. **07**

(b) Explain force voltage analogy with suitable examples. **07**

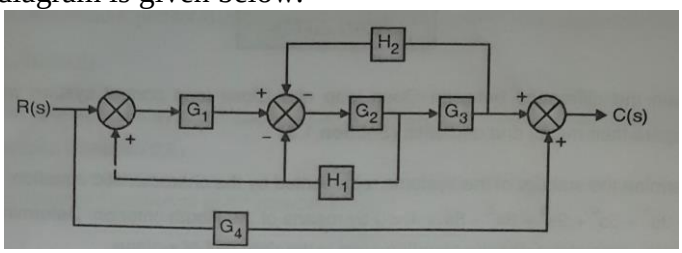
Q.2 **(a)** Determine stability of the systems represented by characteristic equation $S^6+3S^5+5S^4+9S^3+8S^2+6S+4=0$ using routh criteria. **07**

(b) Find out the output response c(t) of the transfer function shown below for the step input. $\frac{C(s)}{R(s)}=\frac{5}{(s+1)}$ **07**

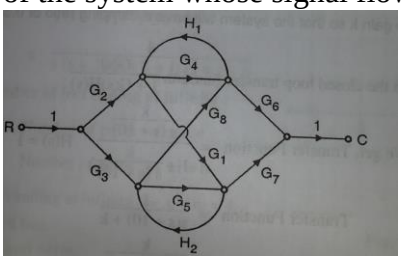
OR

(b) For the unity feedback control system with $G(s)=\frac{k(s+15)}{s(s+2)(s+3)}$ find range of k for stability using routh criteria **07**

Q.3 **(a)** Using block reduction technique find closed loop transfer function of the systems whose block diagram is given below. **07**

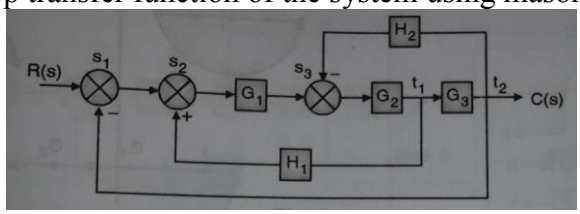


(b) Obtain transfer function of the system whose signal flow graph is given below **07**



OR

Q.3 **(a)** Draw the signal flow graph of the system, whose block diagram is shown below. Obtain closed loop transfer function of the system using mason's gain formula. **07**



(b) Define following **07**

(1) Transfer Function (2) State (3) Self Loop (4) Source Node

(5) Rise Time (6) Settling Time (7) Peak Time

Q.4 **(a)** For the second order system with transfer function given below, obtain maximum percentage overshoot M_p and peak time T_p, $\frac{C(s)}{R(s)}=\frac{4}{s^2+2s+4}$ **07**

(b) A unity feedback control systems has open loop transfer function G(s)=$\frac{k}{s^2(s+2)(s+5)}$ draw root locus indicating clearly the breakaway point, asymptotes and their centroid. **07**

OR

Q.4 **(a)** Define following **07**

1. Centroid
2. Asymptotes
3. Angle of departure
4. Angle of arrival
5. Break away point
6. Phase margin
7. Gain margin

(b) Explain nyquist stability criterion **07**

Q.5 **(a)** What is polar plot? Explain polar plot for type 0,1,2 systems. **07**

(b) Explain standard test signals. **07**

OR

Q.5 **(a)** For the system having open loop transfer function G(s) H(s) =$\frac{10}{s(s+1)(s+10)}$ determine stability of the system by plotting bode plot. **07**

(b) Sketch nyquist plot for G(s)=$\frac{1}{s(s-1)}$ **07**

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