Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC -III-EXAMINATION – Winter- 2015

Subject Code: X30903 **Date:23/12/2015**

Subject Name: Control Theory

Time:10.30am-01.00pm **Total Marks: 70**

Instructions:

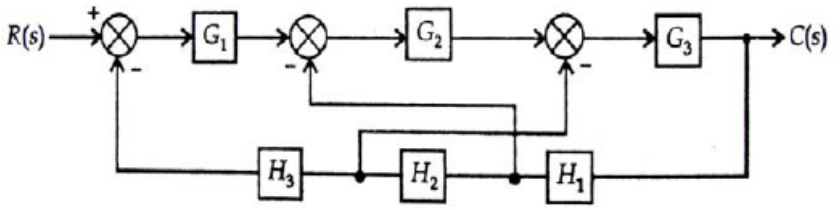
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Derive transfer function for an armature controlled d.c.motor. **07**

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

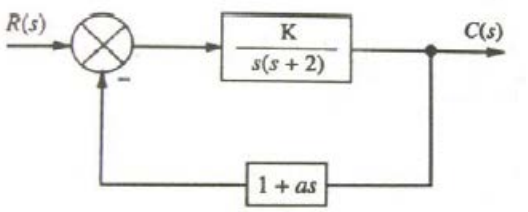
Q.2 **(a)** Give the advantage of signal flow graph method over block diagram reduction method. **07**

(b) Determine close loop transfer function of the system shown below using block diagram reduction techniques. **07**



OR

(b) Determine the value of '*K*' and '*a*' such that the system has a damping ratio of 0.7 and an undamped natural frequency of 4 rad/sec for the system shown below. **07**



Q.3 **(a)** Write notes on "Phase Lag – Lead compensation" **07**

(b) Explain : (I) Gain Margin (II) Phase Margin **07**
(III) Gain crossover frequency (IV) Phase crossover frequency

OR

Q.3 **(a)** Explain the fact that for any system, the set of state variables are non-unique. **07**

(b) Comment on the stability of a closed loop system whose open-loop transfer function is, as given below, using Nyquist stability criterion. Draw Nyquist contour and corresponding G(s)H(s) contour. **07**

$$\frac{10}{(1+0.1S)(1+0.5S)}$$

Q.4 **(a)** Explain about integral action and derivative action on system performance. Can integral action be used alone ? **07**

(b) Give one example of an open loop stable system and open loop unstable system. Explain about stability of the system. **07**

OR

Q.4	**(a)**	Explain about time constant of first order and second order system.	**07**
	(b)	Explain Bode plot with any suitable example wherein the system has one zero and three poles.	**07**
Q.5	**(a)**	Compare the time domain and frequency domain system.	**07**
	(b)	Derive the transmission parameters.	**07**

OR

Q.5	**(a)**	Using Routh's criterion check the stability of a system whose characteristic equation is given by $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$	**07**
	(b)	Write note on steady state error and error constants.	**07**

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