Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-VIth SEMESTER-EXAMINATION-MAY-2012

Date: 17-05-2012 **Time: 10:30am to 1:00pm**

Subject code: 160104 **Subject Name: Basic Control Theory**

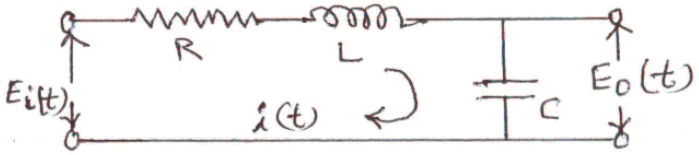
Total Marks: 70

Instructions:

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

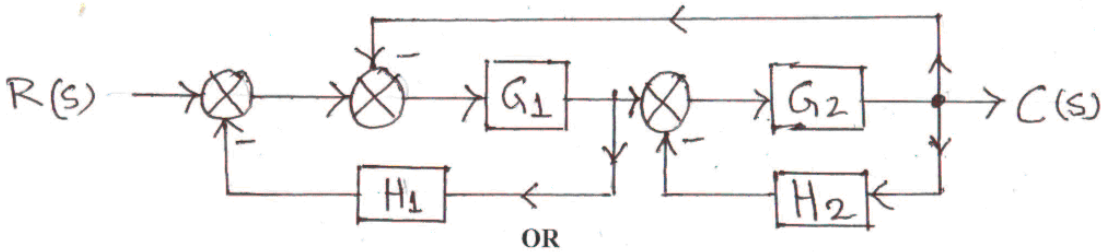
Q.1 **(a)** Which are the different ways in which control systems can be classified? What are open and closed loop control systems? What are their relative advantages and disadvantages? **07**

(b) Briefly explain concept of transfer function in control systems. What are advantages & disadvantages of this system? Find the transfer function of the following network. **07**



Q.2 **(a)** What is basic concept of block diagram representation. Explain with the help of any example. What are it's advantages and disadvantages? **07**

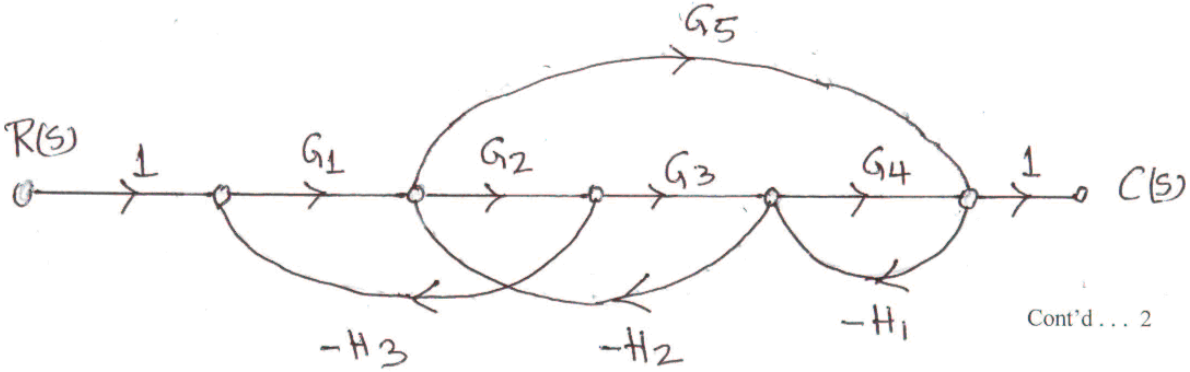
(b) Explain the rules for block diagram reduction. Reduce the following block diagram to it's simple form and hence obtain C(s)/R(s). **07**



OR

(b) What do we understand by signal flow graph representation? What are it's properties? What terminology is used? **07**

Q.3 **(a)** Find C(s)/R(s) for S.F.G. shown below: **07**



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(b) What is time response of a control system? What type of inputs are commonly used to test the control systems? What are transient response specifications? Explain with the help of diagram. **07**

OR

Q.3 **(a)** With the help of examples explain different states of stability like stable, unstable, critically stable and relative stability. **07**

(b) What is the Hurwitz's criterion of stability? What are it's disadvantages? Discuss the stability of the following system using Roth-Hurwitz Method. **07**

$$S^3 + 6s^2 + 11\,s + 6 = 0$$

Q.4 **(a)** What are the advantages and disadvantages of frequency domain analysis of control systems over time response analysis? **07**

(b) Which two plots constitute Bode plot? What steps are followed to sketch Bode Plot? What are frequency response specifications? Explain with the help of diagrams. **07**

OR

Q.4 **(a)** For an unity feedback control system $G(s) = \dfrac{20}{S(1+0.1S)}$ Draw Bode Plot. Determine gain and phase margins, ω_{gc} ω_{pc}. Comment on the stability. **07**

(b) Sketch rough nature of polar plot for a system with **07**

$$G(s)\,H(s) = \frac{10}{S(S+1)(S+2)}$$

Calculate it's gain margin in dB and comment on it's stability

Q.5 **(a)** A unity feedback control system has open loop transfer function as **07**

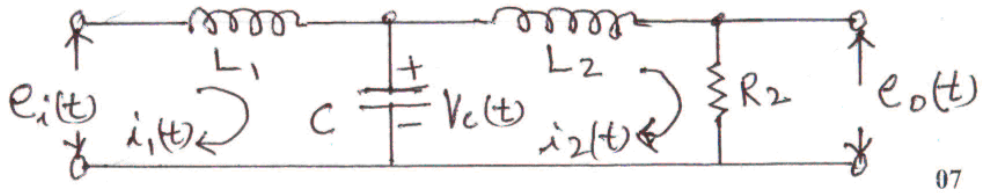
$$G(s)\,H(s) = \frac{S+1}{S^2(S-4)}$$

Sketch Nyquist plot, and determine the stability of the closed loop system.

(b) What is Nyquist's stability criterion? Explain generalized Nyquist Path and it's Mapping. Write steps to solve problems by Nyquist criterion. **07**

OR

Q.5 **(a)** What are the advantages of modern control theory (state space techniques) over classical control theory (systems modeling & design). Obtain state model of the following electrical network in the standard form. **07**



(b) Explain basic concept of root locus. Sketch complete root locus for the system having **07**

$$G(s)\,H(s) = \frac{K}{S(S^2+2S+2)}$$