Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV(OLD) • EXAMINATION – WINTER 2016

Subject Code:141701 Date:23/11/2016

Subject Name:Control Theory

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.**

Q.1 **(a)** Briefly explain the first order system and its time response to a unit ramp input. **07**

(b) Explain open loop and closed loop control system with suitable example & gives its advantages and disadvantages. **07**

Q.2 **(a)** Define terms: **07**

1) Source node 2) self loops 3) Transfer function 4) Non touching loops
5) Sink node 6) Forward path 7) Chain node

(b) Obtain closed loop transfer function of the following system using Block Diagram Reduction. **07**

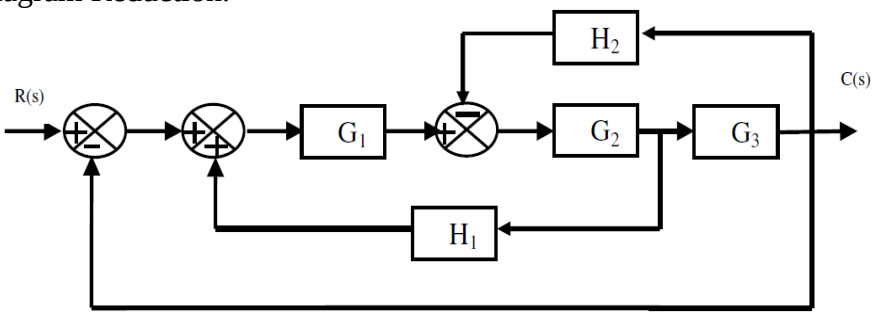

Fig. 1

OR

(b) Obtain transfer function for the electrical network shown in figure. **07**

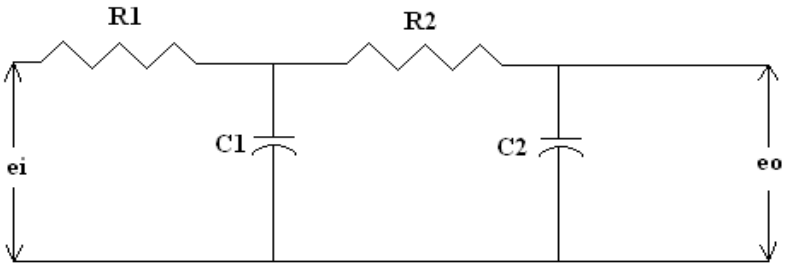

Fig.2

Q.3 **(a)** Explain standard Test signals & derive equation of steady state error. **07**

(b) For the unity feedback control system with **07**

$$G(s) = \frac{k}{s(s+1)(s+2)}$$

Find the range of *K* for system that will cause the system to be stable, marginally stable and unstable. Make suitable comments.

OR

Q.3 **(a)** State and explain Nyquist Stability criteria. Explain about phase margin and gain margin using Nyquist plot. **07**

(b) An instrument serve for controlling position is damped with velocity feedback as shown in fig .3 **07**

a) If R is unit step, what is the response of the system and the steady state error
b)What is the system static error coefficient?

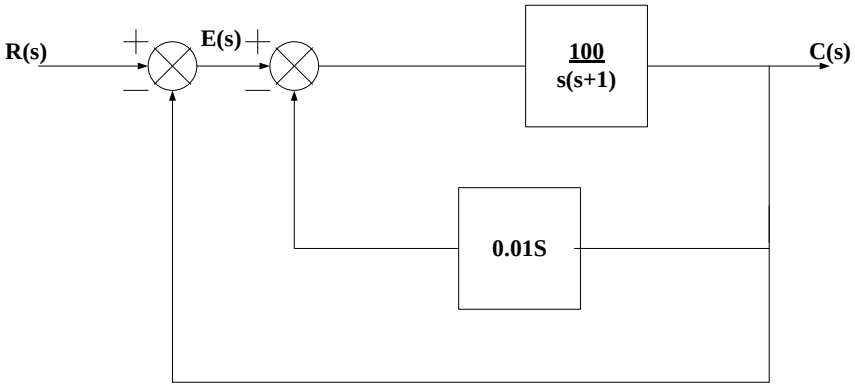

Fig.3

Q.4 **(a)** Explain force voltage analogy with suitable example. **07**

(b) Draw the root-locus diagram for close loop system whose transfer Function is given by **07**

$$G(s)H(S) = \frac{k\ (S+4)(S+5)}{(s+1)(s-1)}$$

OR

Q.4 **(a)** Draw the bode plot bode for following system. Also find phase and gain margin. **07**

$$G(s) = \frac{10\ (1+0.5S)}{S(1+0.1S)(1+0.2S)}$$

(b) Write a short note on thermal system, its modeling and analysis for two different inputs. **07**

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

(b) An open loop transfer function of a system is given by following system also Prepare Nyquist plot for it. **07**

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

OR

Q.5 **(a)** Define the following terms with respect to root locus **07**
(1) Centroid (2) Asymptote (3) Angle of departure (4) Angle of arrival
(5) Break away point

(b) Explain the various rules for construction of root locus. **07**

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