Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI- EXAMINATION – SUMMER 2016

Subject Code:160104 **Date:17/05/2016**

Subject Name:Basic Control Theory

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

Instructions:

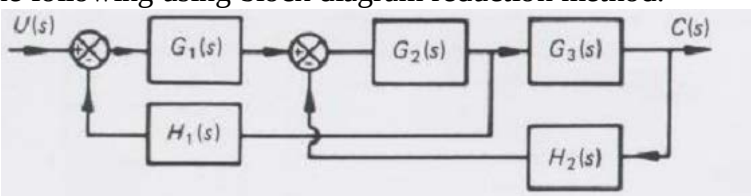
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Difference between open loop and closed loop system with examples in detail. **07**

(b) Explain Time domain specifications with neat diagram. **07**

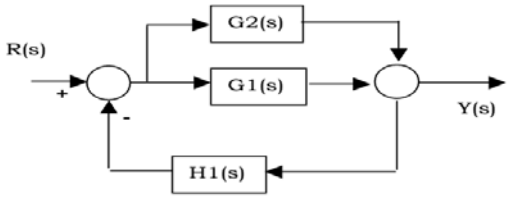
Q.2 **(a)** Derive Mason's Gain formulae. **07**

(b) Simplify the following using block diagram reduction method. **07**



OR

(b) Simplify the following using Mason's gain formulae. **07**



Q.3 **(a)** Define steady state error (e_{ss}). Also find e_{ss} for type 0, 1, 2 with step, ramp and parabolic input. **07**

(b) Explain the steps for plotting the root locus. **07**

OR

Q.3 **(a)** Using Routh's criteria comment the stability of the following system: **07**

$$G(s) = 3s^4+10s^3+5s^2+5s+2=0.$$

(b) Consider a fourth order system with the characteristic equation: **07**

$$S^4+8s^3+18s^2+16s+5=0.$$

Using Hurwitz method calculates the stability of the system.

Q.4 **(a)** Draw the root locus of a feedback system with characteristic equation: **07**

$$1+K/s(s+1)(s+2)=0.$$

(b) The open loop transfer function of a feedback system is: **07**

$$G(s)H(s)=K/s(s+4)(s^2+4s+20)$$

Draw the root locus of the system and find K.

OR

Q.4 **(a)** Draw the bode plot of the following system. Also calculate G.M. and P.M. **07**

$$G(s)H(s)=10/s(s+4)(s+2)$$

(b) Draw the bode plot of the following system. Calculate G.M. and P.M. **07**

$$G(s)H(s)=10s/s(s+5)(s+10)$$

Q.5 **(a)** A unity feedback system is characterized by an open loop transfer function G(s) =K/s(s+10). Determine the value of k, so that the system will have damping ratio of 0.5. For the value of K, determine time domain specifications. **07**

(b) Explain the steps for plotting the bode plot and also explain gain margin and **07**

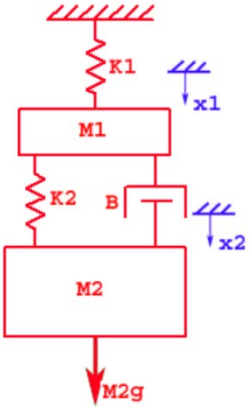
phase margin in bode plot.

OR

Q.5 **(a)** Determine the stability of the following system whose characteristic equation is given by: **07**

$$S^5+1.5s^4+2s^3+4s^2+5s+10=0.$$

(b) Obtain the analogous electrical circuit based on force- current analogy for the figure below:. **07**



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