Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C Sem-III Examination May 2011

Subject code: X30903 **Subject Name: Control Theory**

Date:25/05/2011 **Time: 10.30 am – 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.**
4. **Use of Graph Paper / Semi-log Graph Paper is permissible.**

Q.1 **(a)** State and explain the necessary and sufficient conditions as applied to Routh hurwittz criterion, so that all the roots of the characteristic equation F(S) lie in the left half of the s Space. **07**

(b) State and explain the principle of arguments. How it is applied in the Nyquist stability criterion to determine system stability **07**

Q.2 **(a)** Define term signal flow graph and using Manson's gain formula. **04**

(b) The characteristics equation of a system in differential equation form is $\ddot{x}$ - (K+2) $\dot{x}$ + 92K+5) x = 0 find the values of K for which the system is (i) stable (ii) limitedly stable (iii)Unstable **10**

OR

(b) Explain the time domain specification for transient response of second order system with the unit step input with diagram **10**

Q.3 **(a)** What is root-locus? State and define types of root- locus. **04**

(b) A unity feedback control system has an open-loop transfer function **10**

$$G(S) = \frac{K\left(s + \frac{4}{3}\right)}{s^2(s + 12)}$$

Sketch the root-locus plot. Determine the value of K for which all the roots are equal. What is the value of these roots?

OR

Q.3 **(a)** Define Following term: **07**

(i) State.
(ii) State Variables.
(iii)State Vector.
(iv)State Space.

(b) Compare Block diagram and Signal flow graph method. **07**

Q.4 **(a)** Define steady state error. Derive equation for steady state error (e_{ss}). **07**

(b) Explain in brief the frequency response specifications and time response specifications **07**

OR

Q.4	**(a)**	Mention the types of rules used for the block diagram reduction technique.	**07**
	(b)	State and explain necessary sufficient condition as applied to R-H Criterion so that all the roots of the characteristic equation F(s) lie in the left half of the S plane.	**07**
Q.5	**(a)**	Give the advantages of bode plots.	**04**
	(b)	Sketch the Nyquist plot of the open loop transfer function of unity feedback control systems $GH(s) = \frac{K(s+2)}{s^2(s+4)}$	**10**

OR

Q.5	**(a)**	Explain the general procedure for constructing the Bode Plot	**07**
	(b)	What is analogues system, explain the force voltage and force current analogy with suitable example.	**07**

****