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(Following Paper ID and Roll No. to be filled in your answer book)

Paper ID: **Roll No**

M.Tech
FIRST SEMESTER EXAMINATION, 2007-2008
ADVANCE CONTROL SYSTEM

Time: 3hrs. *Max. Marks:100*

Note: Attempt any Five questions. All questions carry equal marks.

Q.1 Attempt any Two of the following:-

(a) Determine the controllability and observability properties of the following systems (i) A= [-2 1; 1 -2] b= [1; 0] c= [1 -1] (ii) A=[-1 0;0 -2 b=[2;5] c=[01].

(b) Given a transfer function
G(s) =10/s(s+1) =Y(s)/U(s)
Construct the state models for this system:
(i) one which is both controllable and observable
(ii) one which is controllable but not observable.

(c) Derive the expression for the nth-order system characterist polynomial; when conversion takes place from state variab model to transfer functions.

Q.2 Attempt any Two of the following:-

(a) What is Liapunov function? State the stability and instability theor of liapunov with its equations.

(b) Discuss in detail
(i) Dead-Zone non-linearity
(ii) Saturation non-linearity
(iii) On-Off non-linearity with dead zone.

(c) A system has matrix differential equation
$\dot{x}$= [0 1, 2 0]x+[b_1,b_2]u.
What values for b_1 and b_2 are required so that the syster controllable?

Q.3 Attempt any **Two** of the following:-

(a) Discuss the small gain theorem and robust stabilization in detail.
(b) Write note on optimal control with an example.
(c) Linearization of nonlinear systems

Q.4 Attempt any **Two** of the following:-

(a) Write the statement of the sampling theorem. Draw the block diagram representation of the S/H device; also define the following (i) Acquisition Time (ii) Aperture Time (iii) Settling Time (iv) Hold-Mode Droop.
(b) Define the z-transform. Establish the relationship between the Laplace transform and the z-transform.
(c) Find the z-transform of the unit-step function $u_s(t)$ which is defined as

$$u_s(t)=1 \quad t>0$$
$$u_s(t)=0 \quad t<0.$$

Q.5 Write the short notes on the following:-

(i) Robust control and system sensitivity
(ii) Statement of Lure Problem

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