

III B.Tech II Semester Supplementary Examinations, April/May 2005
ADVANCED CONTROL SYSTEMS
(Electronics & Control Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. State the basic theorem for determining the concept of controllability of time varying system utilizing state transition matrix. Explain the same with proof.
2. (a) State and prove two Lyapunov stability and instability theorems.
 (b) Consider a system described by the following equations

$$\dot{x}_1 = -3x_1 + x_2$$

$$\dot{x}_2 = x_1 - x_2 - x_2^3$$
 Investigate the stability of equilibrium state.
3. (a) Explain the design of full-order state observer?
 (b) Consider the system

$$\text{with } A = \begin{bmatrix} 0 & 20.6 \\ 1 & 0 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad C = [0 \ 1]$$

Design a full-order state observer. Assume that the desired eigen values of the observer matrix are $\mu_1 = -1.8 + i2.4$, $\mu_2 = -1.8 - i2.4$.

4. (a) Explain Minimum - Time problem?
 (b) Explain State Regulator problem in brief?
5. Illustrate with an example the problem with terminal time t_1 fixed and $x(t_1)$ free.
6. (a) Derive the transfer matrix relation from state space representation
 (b) The state space triple (A, B, C) of a system is given by

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 2 & 3 & 0 \\ 1 & 1 & 1 \end{bmatrix}; B = \begin{bmatrix} 0 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}; C = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
 Calculate the input and output decoupling zeros, if any. Is the matrix A cyclic? Find out the transfer matrix T(s).
7. Design a phase lead compensator such that a system with $G(s) = \frac{8}{s(s+1)(s+4)}$ has a phase margin of 45° and a steady state error of 0.25 due to ramp input Write a MATLAB Programme for the above problem.
8. Explain about control system tool box in connection with MATLAB commands giving examples.
