Total No. of Questions : 8] *[Total No. of Printed Pages : 2*

Roll No.....................................

MEPE-103

M.E./M.Tech. I Semester

Examination, June 2017

Advanced Control System

Time : Three Hours

Maximum Marks : 70

Note: i) Answer any five questions.
ii) All questions carry equal marks.

1. a) What do you understand by mapping from s-domain to z-domain? Why such type of the mapping required in control systems.

   b) What are the rules for plotting root locus? Explain the method of Stability prediction based on root locus method.

2. a) Explain the method of derivation of transfer function from state model.

   b) What do you understand by diagonalization? Discuss it with examples.

3. Consider a control system with state model

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \end{bmatrix} [u]$$

$$\begin{bmatrix} x_1(0) \\ x_2(0) \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad u = \text{unit step}$$

Compute state transition matrix and state response $x(f)$. $t > 0$

4. Consider a linear autonomous system described by the state equation.

$\dot{x} = \bar{A}\bar{x}$

The linear system is asymptotically stable in the large at the origin if and only if give any symmetric positive definite matrix Q these exists a symmetric positive definite matrix $\bar{P}$. Prove that $\bar{P}$ can be expressed by following unique relationship

$\bar{A}^T\bar{P} + \bar{P}\bar{A} = -\bar{Q}$ symbols have standard meaning

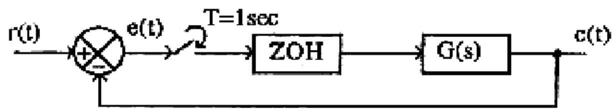
5. Solve the difference equation given below

$x(k+2) - 3x(k+1) + 2x(R) = 4^k$

$x(0) = 0 \quad x(1) = 1$

6. For following sampled data system find response to unit step input.

Given $G(s) = \dfrac{1}{s+1}$



7. Obtain the control law which minimizes the performance index

$$J = \int_0^\infty (x_1^2 + u^2)dt \text{ for system } \begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

8. Write short notes on any two of the following
   i) Variational calculas
   ii) Euler Lagrange equations
   iii) Phase plane technique
   iv) Variable structure central

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