Q.P. Code: **16EE7501** **R16**

**Reg. No:** | | | | | | | | | | |

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**

(AUTONOMOUS)

**M.Tech I Year I Semester (R16) Regular Examinations December 2016**

**SYSTEM THEORY**

(Common to CS & PE)

(For Students admitted in 2016 only)

Time: **3 hours** Max. Marks: **60**

(Answer all Five Units **5 X 12 =60** Marks)

**UNIT-I**

**Q.1** a. What are the properties of State Transition Matrix? And also Derive the Solution of state equations. 6M

b. What are the techniques are available for obtaining the state space representation of transfer function systems in detail 6M

**OR**

**Q.2** a. State the similarity transformation and describe the invariance of system properties due to similarity transformation 6M

b. Compute $e^{At}$ if A= $\begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$ 6M

**UNIT-II**

**Q.3** a. State the necessary and sufficient conditions for Pole assignment by state feedback using Ackermann's formula in detail? 6M

b. Consider a linear system described by the transfer function y(s)/u(s) = 10 / ( s (s + 1) ( s + 2 )). Design a feedback controller with a state feedback so that the closed loop poles are placed at -2, (-1+j1), (-1-j1) 6M

**OR**

**Q.4** a. Explain the fundamental theorem of feedback control 5M

b. The state model of a system is given by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} [u] \; ; \; y = [1 \quad 0 \quad 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}.$$

Convert the state model to controllable canonical form. 7M

**UNIT-III**

**Q.5** Explain the linear quadratic regulator problem. 12M

**OR**

**Q.6** a. Describe the solution of algebraic Riccati equation using iterative method. 6M

b. Derive the solution or Riccati equation using eigen values and eigen vector method. 6M

**UNIT-IV**

**Q.7** a. Consider the system described by the state model , $\dot{X}$ = AX, Y = CX Where A = $\begin{bmatrix} -1 & 1 \\ 1 & -2 \end{bmatrix}$, C = [ 1 0 ] design a full order state observer. The desired Eigen values for the observer matrix are $\mu_1 = -5$, $\mu_2 = -5$. 5M

b. Consider the system $\dot{X}=\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}X+\begin{bmatrix} 1 \\ 1 \end{bmatrix}U$; $Y=\begin{bmatrix} 2 & -1 \end{bmatrix}X$. Design a reduced ordered observer that makes the estimation error to decay atleast as fast as $e^{-10t}$. 7M

**OR**

**Q.8** a. What is observer and reduced order observer. Derive the reduced order observer design. 5M

b. For system

$\dot{X}$ = AX+BU

Y = CX, Where A = $\begin{bmatrix} 0 & 1 \\ 20.6 & 0 \end{bmatrix}$; B = $\begin{bmatrix} 0 \\ 1 \end{bmatrix}$ ; C = $\begin{bmatrix} 1 & 0 \end{bmatrix}$

Draw a block diagram of observed-state feedback control system with the desired closed-loop poles are at $S_1=-1.8+j2.4$ & $S_2=-1.8-j2.4$ and design Eigen value are at S1= -8 & S2= -8 and draw another block diagram with the observer controller as a series controller in the feed forward Path. 7M

**UNIT-V**

**Q 9** State and explain lyapunov's theorem on i) asymptotic stability ii)Global asymptotic stability and iii)Instability 12M

**OR**

**Q.10** a. Write short notes on Model decomposition by state feedback and Disturbance rejection. 7M

b. Describe with a neat sketch the internal stability of a system? 5M

*** **END** ***