APJ Abdul Kalam Technological University

First Semester M. Tech Degree Examination, December 2016

Cluster: **Kollam**

Branch: **EEE**

Specialisation: Power Systems

Subject: **02 EE 6231 Dynamics of Linear systems**

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

Answer all questions from Part A and two questions from Part B

PART- A

1(a) Explain how a lead compensator can be realized using electrical components? (3 marks)

(b) Design a suitable compensator for a unity feedback system with open loop transfer function, G(s) = $\frac{160}{s^2}$ .so as to satisfy the following specifications: Acceleration error constant Ka > 7500/sec^2, Percentage overshoot for unit step input less than 5% and settling time for 2% criterion less than 1 sec. (6 marks)

2. State and explain Lyapunovs stability theorems with examples.

(9 marks)

3. Explain the following

(a) Controllability and Obsevability

(b) Stabilizability and Detectability (4 marks)

(c) Consider the transfer function $\frac{Y(s)}{U(s)} = \frac{(s+3)(s+1)}{s(s+2)(s+5)}$. Obtain the state space representation of the system in controllable canonical form.

(5 marks)

4 (a) Obtain the Bass-Gura formula for the state feedback gain.

(4 marks)

b) Explain

i) Mayne – Murdoch formula

ii) Modal controllability (5 marks)

PART B

5. Find the three dimensional observer with given eigen values -2, -2 and -3 for the system $\dot{X} = AX + BU$ and $Y = CX$ with

$A = \begin{bmatrix} -1 & -2 & -3 \\ 0 & -1 & 1 \\ 1 & 0 & -1 \end{bmatrix}, B = \begin{bmatrix} 2 \\ 0 \\ 1 \end{bmatrix}$, C= $\begin{bmatrix} 1 & 1 & 0 \end{bmatrix}$ (12marks)

6. Explain the procedure to obtain the controllable companion and observable companion form for a MIMO system. (12marks)

7. Convert the following multi input system into Controllable Companion form $\dot{X} = \begin{bmatrix} 0 & 0 & -3 \\ 2 & 0 & -7 \\ 0 & 1 & 0 \end{bmatrix} X + \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ 0 & 1 \end{bmatrix} U.$ (12 marks)

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