**Karunya University**
**(Karunya Institute of Technology and Sciences)**
(Declared as Deemed to be University under Sec.3 of the UGC Act, 1965)

**End Semester Examinations - 2015-16 Even Semester - May 2016**

**14EI3010 Control System Design**

**Set A**

**Time : 3 hrs**
**Total Marks: 100**

1. a. Draw the Pole Zero representation of Lag Compensator. (2)

   b. With a neat graph, describe the Time domain Specifications of Control Systems in detail. (2)

   c. The open loop transfer function of certain unity feedback control system is given by

   $$G(s)=\frac{K}{s(s+4)(s+80)}.$$

   It is desired to have the phase margin to be atleast 33° and the velocity error constant $K_V = 30\ sec^{-1}$. Design a Phase lag series compensator. (16)

**OR**

2. a. Write the transfer function of a PID controller and what are its effects on system performance? (5)

   b. Consider a unity feedback system with open loop transfer function G(s) = $G(s)=\frac{100}{(s+1)(s+2)(s+10)}$.

   Design a PID controller so that phase margin of the system is $45^0$ at a frequency of 4rad/sec and the steady state error for unit ramp input is 0.1. (15)

3. a. What is meant by Aliasing? Describe Aliasing with necessary graphs. (5)

   b. Explain about the Reconstruction of Analog signals. (5)

   c. Derive the mathematical model of zero-order hold circuit. (10)

**OR**

4. a. Derive the relation between the spectrums of the continuous-time signal to that of the discrete-time sequence. (10)

   b. Write the general rules and procedure for design of discrete root loci. (10)

5. a. Derive the Riccati equations for linear tracking problem. (15)

   b. Explain the principle of optimality. (5)

**OR**

6. a. Derive Hamiltonian Jacobi Equations. (15)

   b. Comment on the performance measure minimization state and output regulator problem. (5)

7. a. Discuss various methods for the determination of state feedback gain matrix in pole placement technique. (16)

   b. What are the types of state observers? How do they differ in estimation? (4)

**OR**

8. Consider the system x(k+1)=Gx(k)+Hu(k); where $G=\begin{bmatrix}-1 & 1\\ 1 & -2\end{bmatrix} \& C=[1\ \ 0]$.

   The desired eigen values for the

observer matrix are $\mu_1$= -5 & $\mu_2$= -5. Design a full order state observer by comparing with the desired eigen values and verify that using Ackermann's formula. (20)

9. a. Briefly describe noise characteristics of Luenberger's observer. (10)

b. Write short notes on Kalman bucy filter (10)

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**Wishing you All the Best**

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