

College Of Engineering, Pune

End Semester Exam- Nov 2013

B.Tech(Instru & Control)

(IE405-1)-(Digital Control)

Nov. 2013
Max Marks: 100

Time:
Duration: 3 hours

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1. (a) Compare z-transform with the delta transform. (5)
(b) Given (10)

$$\begin{aligned}x_1(k+1) &= x_2(k) \\x_2(k+1) &= x_1(k) - .03x_2(k) - .05u(k) \\y(k) &= x_1(k)\end{aligned}$$

Design a state observer so that the observer poles will be at -0.4 and 0.5.

- (c) What are the considerations for the selection of observer poles? (5)
2. (a) Find the z transform and modified z transform of $c(t)$ if (16)

$$C(s) = \frac{k}{(s+2)(s+4)}$$

from the first principles.

- (b) Find the z transform and modified z transform of $c(t)$ if (4)

$$C(s) = \frac{k(1 - e^{-sT})}{(s+2)(s+4)}$$

using the result in part(a).

3. (a) Sketch the root locus of a unity feedback system having (10)

$$G(z) = \frac{kz}{(z+a)(z+b)}$$

- (b) Comment on the stability for large k . (2)

- (c) Comment qualitatively on the stability if (8)

i. $b = -0.5, a = -0.75$

ii. $b = -0.5, a = -2$

iii. $b = 2, a = -3$

iv. $b = -2, a = -3$

4. (a) Comment on the stability of a continuous system and a corresponding discrete system. (4)
- (b) Given a unity feedback system with (16)

$$G_{ho}G(z) = \frac{kz}{(z-1)(z+0.8)(z-0.1)}$$

find the range of k for stability using the transformation

$$w = \frac{z-1}{z+1}$$

5. (a) State the advantages and disadvantages of state feedback. (5)
- (b) Given (15)

$$x_1(k+1) = x_2(k)$$

$$x_2(k+1) = x_3(k)$$

$$x_3(k+1) = -0.02x_1(k) - 0.03x_2(k) + 0.9x_3(k) + 0.01u(k)$$

$$y(k) = x_1(k)$$

Design a state feedback so that the closed loop poles will be at 0.1, -0.4 and 0.2.
What considerations decide the choice of desired closed loop poles?