Q 8026

M.E. DEGREE EXAMINATION, MAY/JUNE 2006.

Second Semester

Applied Electronics

AN 1653 — DIGITAL CONTROL ENGINEERING

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out any four frequency domain specifications.

2. What is meant by compensator?

3. Write short notes on aliasing.

4. How sampling time is selected in digital control systems?

5. Define : Pulse transfer function.

6. Obtain z-transform of unit step sequence.

7. What are z-plane design specifications?

8. What is meant by discrete integrator?

9. How KP, KI and KD values are selected in PID control?

10. Write short notes on finite word length effect in digital control systems.

PART B — (5 × 16 = 80 marks)

11. (i) With suitable example, explain the working of continuous time version of PID Controller. (8)

(ii) Derive the digital version of PID control algorithm in velocity form. (8)

12. (a) Obtain the mathematical model of sample and hold process and explain. Also, discuss the effect of sample and holding process in the over all model. (16)

Or

(b) Explain the zero and first order holding process in detail with mathematical model. (16)

13. (a) Determine the z-transfer function of two cascaded systems each described by the difference equation.

$$C(k) = 0.5\,C(k-1) + r(k).$$ (16)

Or

(b) A discrete-time system has the transfer function.

$$T(z) = \frac{4z^3 - 12z^2 - 13z - 7}{(z-1)^2\,(z-2)}$$

Obtain three different state models for the system. (16)

14. (a) Consider the discrete feedback control system as shown in figure 1. The plant is described by the transfer function.

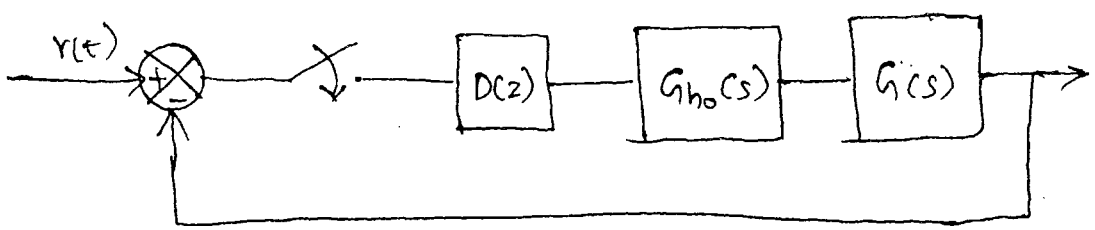

Figure 1.

$$G(s) = \frac{K}{s(s+5)}$$

Design a digital control scheme for the system to meet the following specifications :

(i) The velocity error constant $K_v \geq 10$

(ii) Peak overshoot Mp to step input $\leq$ 2.5% and

(iii) Settling time ts (2% tolerance band) $\leq$ 2.5 sec. (16)

Or

(b) A sampler and ZOH are now introduced in the forward in the figure 2. For a unit-step input, determine the output y(k) for the first five sampling instants when

(i) T = 0.01 sec and

(ii) T = 0.001 sec. Compare the results.

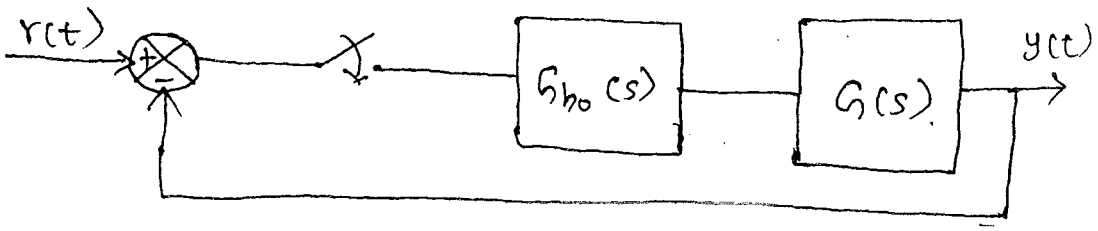

Figure 2.

$$G(s) = \frac{4500K}{s(s+361.2)}; K = 14.5. \quad (16)$$

15. (a) With suitable hardware circuit, explain the microcontroller based temperature control with PID algorithm. (16)

Or

(b) With suitable hardware circuit, explain the microcontroller based speed control. Draw the flow chart of algorithm follow. (16)
