(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0315 Roll No.

B. Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2010-11

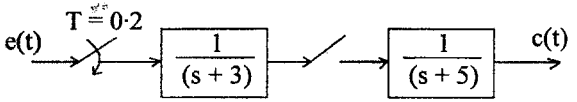
DIGITAL CONTROL ENGINEERING

Time : 3 Hours *Total Marks : 100*

Note : Attempt **all** questions.

1. Attempt any **four** parts : **(5×4=20)**

(a) Find the transfer function for the arrangement given in figure 1.



(b) Find the Z-transform of the (i) $F(s) = 5/s(s^2 + 4)$, (ii) $F(s) = 2(s + 1)\ 5/s(s + 5)$.

(c) Define the Z-transform and discuss its limitations.

(d) Find the inverse Z-transform of :

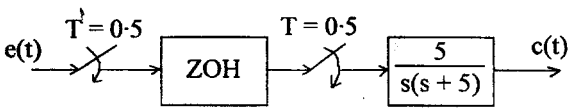
$$F(z) = 2z/(z^2 - 1{\cdot}2z + 0{\cdot}5).$$

(e) The weighting sequence of a linear discrete-data system is :

$g(k) = 0{\cdot}15(0{\cdot}8)^k - 0{\cdot}25(0{\cdot}4)^k$ for $k \geq 0$ and 0 for $k \leq 0$.

Find the transfer function G(z) of the system.

(f) Express the output c(t) in the form of Zero-order Hold sampled data system of the given figure.



2. Attempt any **two** parts : **(10×2=20)**

(a) Find the state models for the following difference equation; also obtain different canonical form for the each system :

$$y(k+3)+5y(k+2)+7y(k+1)+3y(k)=u(k+1)+2u(k).$$

(b) The closed loop transfer function of a unity feedback digital control system is :

$$Y(z)/R(z)=(z+1)/3(z^2-z+1);\ T=1 \text{ sec.}$$

Find the open loop transfer function $G_{ho}.G(z)$. Construct the bode plot for $G_{ho}.G(w)$ on w-plane; determine the Gain margin, Phase margin and resonant peak.

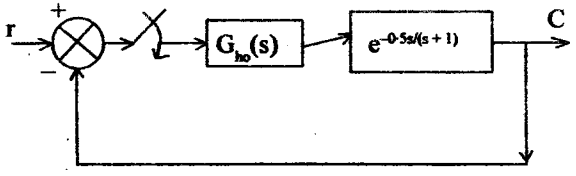
(c) Map the following s-plane values into the z-plane f[illegible] T = 1 and 0·1 :

(i) $s=-1+j2$, (ii) $s=-2\pm j4$, (iii) $s=+4j$.

3. Attempt any **two** parts : **(10×2=20)**

(a) Explain P and PID controllers with suitable block diagram and set of equation.

(b) Find the pulse transfer function for the given sampled data system shown in figure with the process lag as $T_d = 0{\cdot}5$.



(c) Discuss the controllability and observability concepts. Also investigate the controllability and observability o[illegible] the following system :

$$x(k+1)=[2\ -2,\ 1\ -1]\,x(k)+[1\ 1,\ 0\ -1]\,u(k)$$

$$y(k)=[1\ 0,\ 1\ 1]\,x(k).$$

4. Attempt any two parts : **(10×2=20)**

(a) Formulate the optimal state regulator by dynamic programming.

(b) For n_{th} order linear time-invariant plant system, explain the state regulator problem with suitable diagram.

(c) Explain the Stochastic optimal state estimation for dynamic system.

5. Attempt any two parts : **(10×2=20)**

(a) Explain the criteria on which sample rate selection is made and effects of time delay in the microprocessor control.

(b) Explain the following with example (i) Truncation quantizer. (ii) Round-off quantizer and main sources of quantizer errors.

(c) With PIN diagram briefly explain INTEL 8156 static RAM working and programming of I/O ports.