(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

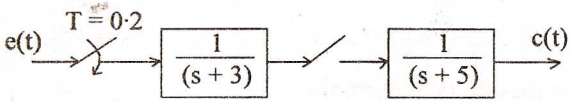
DIGITAL CONTROL ENGINEERING

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 :

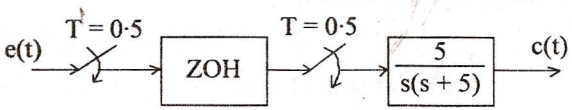
$$F(z) = 2z/(z^2 - 1{\cdot}2z + 0{\cdot}5).$$

(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.

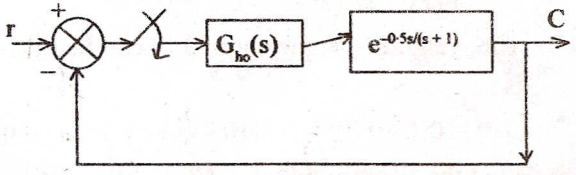
(c) Map the following s-plane values into the z-plane f T = 1 and 0·1 :

(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 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.