(b) Determine the deadbeat observer for the discrete-time system given by

$$x(k+1) = [1\ 0.08,\ 0\ 0.61]\, x(k) + [0.005,\ 0.008]\, u(k)$$

(c) Discuss the salient points of the infinite-state regulator problem with suitable diagram.

5 Attempt any **two** parts : 10×2=20

(a) Draw the block diagram of a μP-based control system, showing μP, ROM, RAM, D/A, A/D and timer circuit, also explain its working.

(b) Find the controllable canonical realization of

$$D(z) = K_1 Z/(Z-\alpha_1) + K_2 Z/(Z-\alpha_2).$$

(c) Discuss the important features of a microcontroller.

TIC-702

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

PAPER ID : 0315 Roll No.

B. Tech.

(SEM. VII) EXAMINATION, 2008-09

DIGITAL CONTROL ENGINEERING

Time : 3 Hours] [Total Marks : 100

Note : Attempt all questions.

1 Attempt any four parts : 5×4=20

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

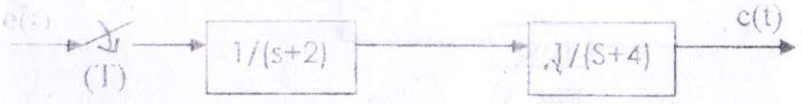

Fig. 1

(b) Find the Z-transform of the $x(t) = \sin \omega t$.

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

(d) Find the inverse Z-transform by power-series expansion method of :
(i) $F(z) = (z+1)\, z / (z^2 - z+1)\, (z-1)$

(e) The weighting sequence of a linear discrete - data system is
$g(k) = 0.15\,(0.6)^k - 0.15\,(0.4)^k$ 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 :

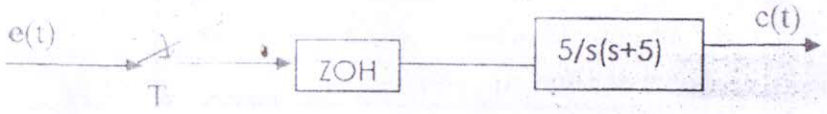

Fig. 2

2 Attempt any four parts : 5×4=20

(a) A feedback block diagram system is shown in the figure, find its closed loop transfer function in z-plane

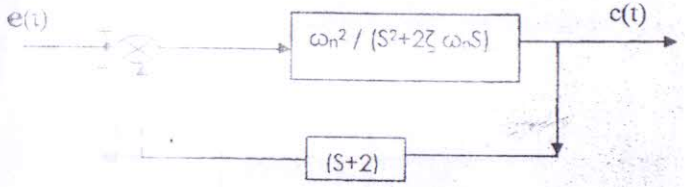

Fig. 3

(b) Explain the concepts of Disturbance rejection for given block diagram :

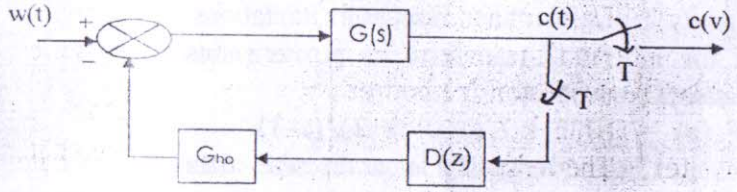

Fig. 4

(c) A unit feedback system has an open loop transfer function $G(s) = K/S^2 (S+4)$, sketch the root locus plots; also find the values of K for stable mode and unstable mode.

(d) Explain PD and PI controllers with suitable block diagram and set of equations.

(e) Find the state space representation in the (i) Controllable canonical form (ii) Diagonal canonical form for the system with transfer function,

$$C(z)/R(z) = (z+5)/(2z^2+3z+1)$$

3 Attempt any **two** parts : 10×2=20

(a) Write the statement of Cayley Hamilton theorem; also compute state transition matrix and matrix exponential.

(b) For the given system state whether the system is stable or not.

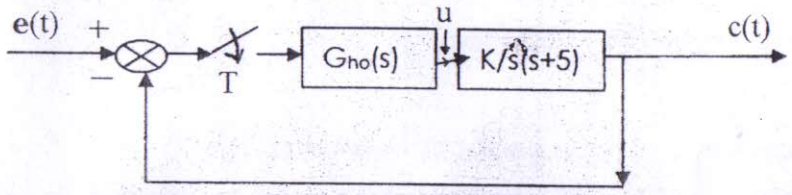

Fig. 5

(c) Test whether following are stable or not using Jury Stability Test :

$$\Delta(z) = 9z^5 + 8z^4 + 6z^3 + 8z^2 + 6z + 1$$

$$\Delta(z) = 3z^5 + 3z^4 + 6z^3 + 7z^2 + 2z + 1$$

4 Attempt any **two** parts : 10×2=20

(a) Formulate the optimal control problem using state space approach.