

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER –II-(Old) EXAMINATION – SUMMER 2019

Subject Code: 2720301

Date: 09/05/2019

Subject Name: Digital Control

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 A Draw the Nyquist plot of $G(z) = \frac{1}{z(z-1)}$. 07
 and find out for what values of K the system becomes unstable.
- B Evaluate the effect of an integrating controller $G_i(z) = \frac{z+1}{z-1}$ 07
 when used with a non-oscillating plant given by $G(z) = \frac{z}{z-a}$, where $a > 0$.
- Q.2 A Examine the effect of using the derivative controller $G_d(z) = \tau d \frac{z-1}{z}$ on the 07
 oscillating plant $G(z) = \frac{z}{z+a}$, where $a > 0$.
- B Verify whether the feedback system given in Figure1, in which 07
 a controller is designed with unstable pole-zero cancellation, is internally stable

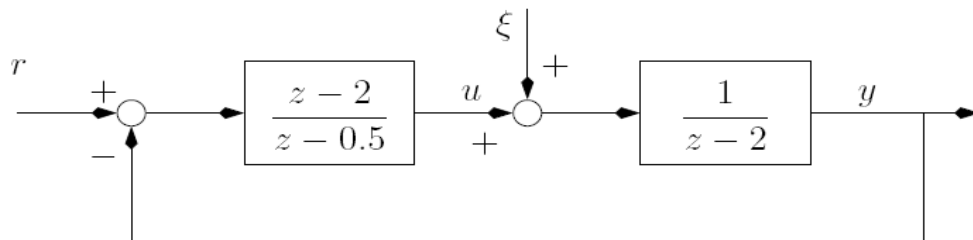


Figure 1

- OR
- B Suppose that plant $G(z^{-1}) = z^{-2} \frac{1}{1-0.5z^{-1}}$, and that we want the closed loop 07
 transfer function as $T(z^{-1}) = z^{-1} \frac{1}{1-az^{-1}}$. Determine the controller that is
 required for this purpose.
- Q.3 Find the ZOH equivalent of $\frac{1}{s^2}$ and $\frac{k}{\tau s+1}$ 14
 OR
- Q.3 Using the state space approach, discretize the following transfer function 14
 $G(s) = \frac{e^{-Ds}}{\tau s + 1}$ where $0 < D < Ts$ and Ts is sampling time.
- Q.4 Discuss the PID controller structure in digital domain which ensures the 14
 smooth transfer from manual to auto mode bumpless transfer.
- OR
- Q.4 Discuss the filtered derivative PID controller structure in digital domain 14
 which ensures the smooth tracking and disturbance rejection in noisy
 environment
- Q.5 Discuss the 2-DOF digital modified Pole Placement Controller 14
 using internal model principle and verify the robustness of the controller to
 perturbations in initial conditions
- OR
- Q.5 Discuss the state feedback controller and estimator combination in detail. 14
