

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VIII (NEW) EXAMINATION – WINTER 2018

Subject Code: 2181705
Date: 29/11/2018
Subject Name: Advance Control Theory
Time: 02:30 PM TO 05:00 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) | Introduce terms positive definite, negative definite and indefinite function. | 03 |
| (b) | Discuss about mapping between s and z domain. | 04 |
| (c) | Describe fuzzification and defuzzification in detail. | 07 |

- Q.2**
- | | | |
|-----|--|----|
| (a) | Discuss about zero-order hold. | 03 |
| (b) | Discuss error dynamics of full order state observer. | 04 |
| (c) | Consider the system $x(k+1) = Gx(k) + Hu(k)$ where $G = \begin{bmatrix} 0 & 1 \\ -0.16 & -1 \end{bmatrix}$ and | 07 |

$H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$. Determine a suitable state feedback gain matrix K such that the system will have the closed loop poles at $z = 0.5 \pm j0.5$.

OR

- | | | |
|-----|---|----|
| (c) | Discuss stability in the sense of Lyapunov and state Lyapunov theorem on stability. | 07 |
|-----|---|----|
- Q.3**
- | | | |
|-----|---|----|
| (a) | Give difference between full order observer and minimum order observer. | 03 |
| (b) | Obtain discrete time pulse transfer function by taking z transform when the sampling period T=1 of the following continuous time system | 04 |

$$G(s) = \frac{1}{s(s+2)}$$

- | | | |
|-----|--|----|
| (c) | Describe about digital implementation of PID controller. | 07 |
|-----|--|----|

OR

- Q.3**
- | | | |
|-----|--|----|
| (a) | State and briefly explain sampling theorem. | 03 |
| (b) | Write about interaction and decoupling in multivariable systems. | 04 |
| (c) | Obtain discrete time state and output equations when the sampling period T=1 of the following continuous time system | 07 |

$$G(s) = \frac{1}{s(s+2)}$$

- Q.4**
- | | | |
|-----|---|----|
| (a) | Comment on describing function analysis for nonlinear systems. | 03 |
| (b) | Brief about phase plane analysis. | 04 |
| (c) | Explain any four types of common nonlinearities in instruments. | 07 |

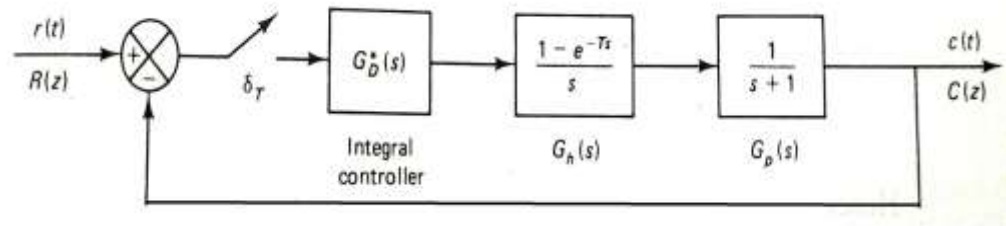
OR

- Q.4**
- | | | |
|-----|---|----|
| (a) | Comment on stability of nonlinear systems. | 03 |
| (b) | Write a note on phase trajectories. | 04 |
| (c) | Discuss two degree of freedom controller design with example. | 07 |

- Q.5**
- | | | |
|-----|--|----|
| (a) | Give introduction about relative gain array for multivariable systems. | 03 |
| (b) | Explain jump resonance in non-linear system. | 04 |
| (c) | With sketch explain terms stability, asymptotic stability and Instability. | 07 |

OR

- Q.5 (a) Introduce membership functions for fuzzy logic based systems. 03
 (b) Discuss fuzzy logic applications in control systems. 04
 (c) Draw root locus diagrams in the z plane for the system shown in Fig. for 07
 the sampling period $T=2$ sec and $G_D(z) = \mathbf{Z}(G_D^*(s)) = K \frac{z}{z-1}$.



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