

Sr. No. of Question Paper : 7301 **L**

Unique Paper Code : 2513010028

Name of the Paper : Digital Control System

Name of the Course : **B.Sc. (H) Electronics**

Semester : VIII

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **seven** questions in all, out of which you have to attempt any **five** questions.
3. **All** questions carry equal marks.
4. Sub-parts can be given.
5. **First** Question is Compulsory.

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|---|---|---|
| 1 | (a) Write the advantages of digital controllers over analog controllers. | 3 |
| | (b) What is the pulse transfer function? | 3 |
| | (c) Compare Jury's method and bilinear transformation method to check the stability of a digital control system. | 3 |
| | (d) What is the significance of the unit circle in the z plane in terms of the stability of the digital control system? | 3 |
| | (e) How are state-space models better than control system methods based on transfer functions? | 3 |
| | (f) Differentiate between Lead and Lag Compensator. | 3 |

- Unit step
- Unit ramp

(c) Derive the pulse transfer function of

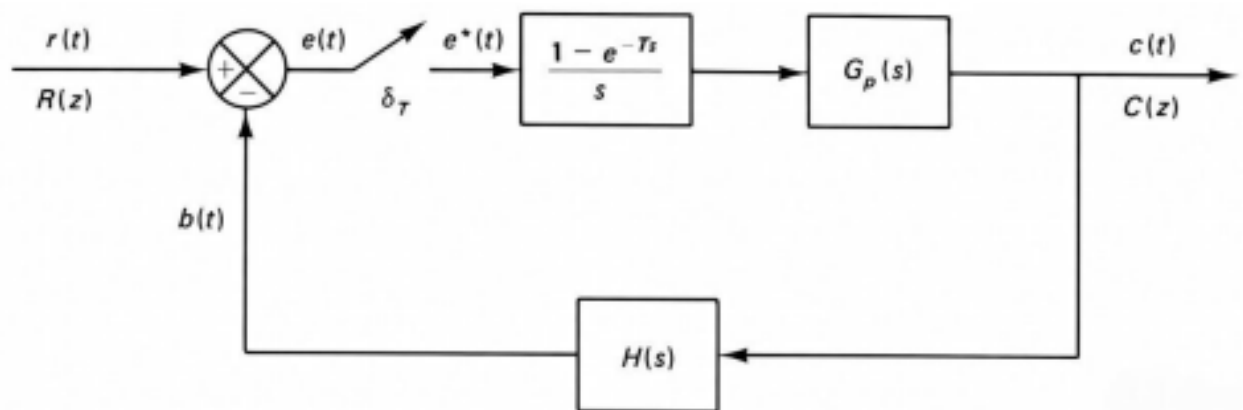
$$G(s) = \frac{1}{s(s+2)} \quad \text{with sampling time } T.$$

(a) Check the stability of the control system having the following characteristic equation using Jury Stability Test:

$$P(z) = z^3 - 1.1z^2 - 0.1z + 0.2 = 0$$

(b) Explain how the z plane is mapped with w plane in bi-linear transformation method to check the stability of any digital control system.

(c) Derive the expression for the steady state error of the following discrete control system. Using the result, obtain the static position error control.



(a) Define state, state variables, state vectors and state space equations. Describe the significance of each matrix A, B, C and D in the model.

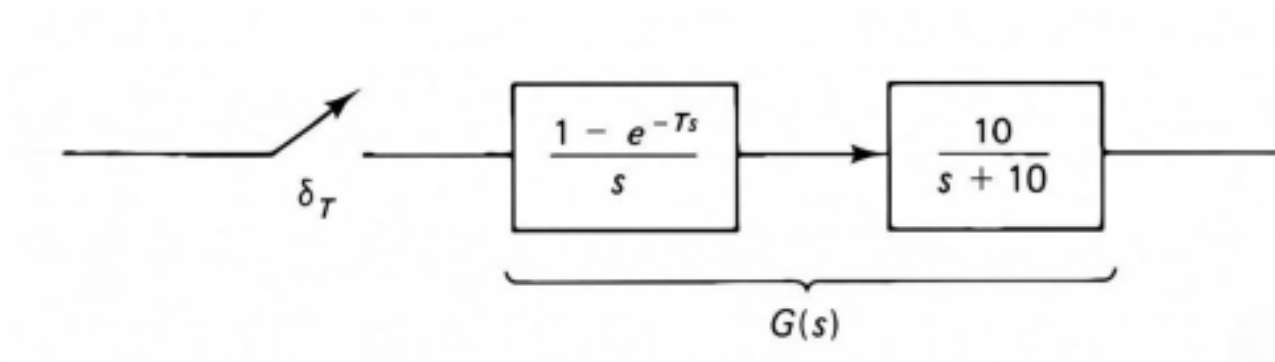
(b) Differentiate between the Controllable and Observable canonical form of state space representation of Discrete time control system.

(c) For the discrete-time control system with transfer function given below;

ii) Find its controllable canonical form.

iii) Find its diagonal canonical form.

5 (a) Obtain $G(w)$ for the following transfer function:



(b) A digital PID controller has the parameters:

$K_p = 2$, $K_i = 0.5$, $K_d = 1$ Error values are: $k = 0, 1$ and $e(k) = 1, 0.8$. Find the control signal $u(1)$.

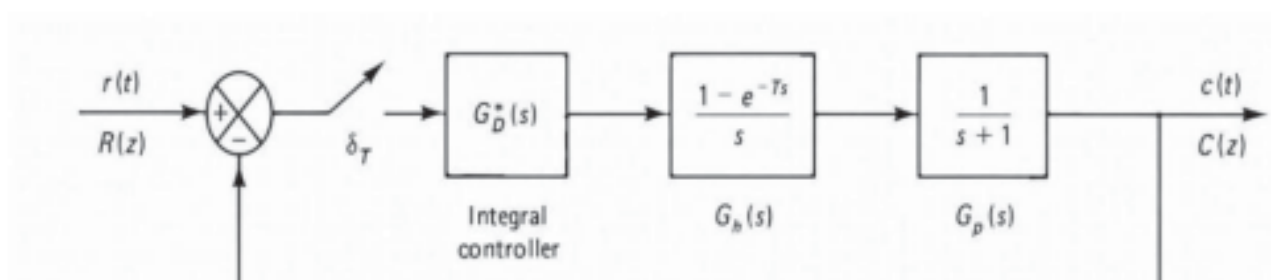
(c) How does feedback controller through the Pole placement method improve the performance of the controller?

6 (a) State the Nyquist–Shannon sampling theorem.

(b) Find the inverse Z-transform of

$$X(z) = \frac{z}{z - 0.8}$$

(c) Draw the root locus diagram for the following system for sampling period 2 second.



of discrete state space models?

- (b) What is the primary objective of a deadbeat controller? What conditions must be met for a system to achieve a deadbeat response? Also, discuss which types of applications require it.