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B TECH
(SEM-VI) EVEN SEM. THEORY EXAMINATION, 2017-18
DIGITAL CONTROL SYSTEM

Time: 3 Hours

Max. Marks: 100

SECTION – A

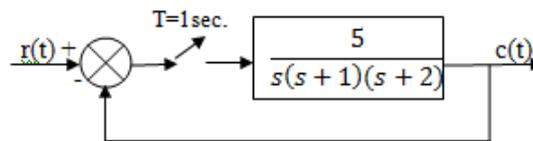
1. Attempt all parts of the following. (10*2=20)

- (a) What is the condition for sampling of a signal in sampling theorem?
- (b) Define the Aperture time for sample and hold operation.
- (c) What is ideal sampler?
- (d) Define State transition matrix.
- (e) Define the term (a) State variable (b) State space
- (f) Define the bilinear transformation.
- (g) Give the statement of Caley-Hamilton theorem.
- (h) Define the singular point.
- (i) Gives the name of optimal control problems.
- (j) Find the stability of polynomials $3r^5 + 2r^4 + 4r^2 + 5 = 0$, using Routh Hurwitz criterion.

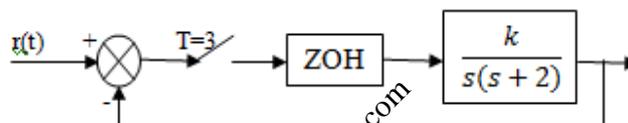
SECTION – B

2. Attempt any FIVE parts of the following: (5*10=50)

- (a) Draw the basic digital control system and explain the function of each block. Also discuss the sampling effects.
- (b) (i) Describe the sample and hold operation.
(ii) Discuss the relationship between Laplace transform and Z transform.
- (c) Explain and determine the pulse transfer function of a given system.



- (d) Derive the expression Euler Lagrange equation for maximum and minimum principle for optimization.
- (e) Define the term performance index and enlist important requirements of performance index. Discuss different error performance indexes.
- (f) Sketch the root locus plot for the system shown in fig. on the z-plane and obtain the value of 'K' that result in marginal stability the sampling time period T=3 sec.



- (g) Determine the controllability and observability of the following system,

$$x(k+1) = \begin{bmatrix} 2 & -2 \\ 1 & -1 \end{bmatrix} x(k) + \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix} u(k)$$

$$y(k+1) = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} x(k)$$

- (h) Explain Jury stability criteria. Determine the stability of the system using Jury stability test of a given system

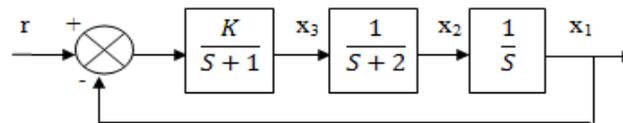
$$\Delta(z) = 7z^5 + 8z^4 + 6z^3 + 8z^2 + 6z + 1$$

SECTION - C

Note: - Attempt any two of the following:

(2*15=30)

3. Determine the stability and range for K of the system shown in fig. using Lapunov equation.



4. (a) Solve the difference equation

$$y(k+2) + 3y(k+1) + 2y(k) = 0; y(-1) = -\frac{1}{2}, y(-2) = 3/4$$

- (b) Compute the state transition matrix using Caley-Hamilton theorem of a given system

$$A = \begin{bmatrix} 0 & 0 & -2 \\ 0 & 1 & 0 \\ 1 & 0 & 3 \end{bmatrix}$$

5. Obtain the companion first form, second form and Jordan canonical form realizations and draw block diagram for the transfer function

$$\frac{Y(z)}{U(z)} = \frac{4z^3 - 12z^2 + 13z - 7}{(z-1)^2(z-2)}$$