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BIEEE-002

B.Tech. – VIEP – ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

00655

June, 2019

BIEEE-002 : DIGITAL CONTROL SYSTEM

Time : 3 hours

Maximum Marks : 70

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is allowed.*

1. Explain in detail the configuration of basic digital control scheme. Also write down the advantages of digital control over conventional control. *10*

2. Derive the expression for first-order hold and discuss its frequency domain characteristics. Explain the working of first-order hold devices with neat sketch. *10*

3. Obtain the inverse Z-transform of

$$X(z) = \frac{z(z+2)}{(z-1)^2}$$

using direct division and partial fraction method. *10*

4. Consider the discrete time system

$$y(k + 2) + 0{\cdot}25\, y(k + 1) - 0{\cdot}125\, y(k) = 3\, u(k + 1) - u(k)$$

with input $u(k) = (-1)^k$ and initial conditions $y(-1) = 5$ and $y(-2) = 6$. Determine the output $y(k)$ for $k \geq 0$. *10*

5. Consider the discrete time system with unity feedback whose open-loop pulse transfer function is given as

$$G(z) = \frac{K(0{\cdot}3679z + 0{\cdot}2642)}{(z - 0{\cdot}3679)\,(z - 1)}.$$

Determine the range 'K' for Jury's Stability test. *10*

6. Describe the conversion of transfer function to canonical state variable model in second companion form. Also obtain second companion form of the system *10*

$$X(z) = \frac{4z^3 - 12z^2 + 13z - 7}{(z - 1)^2\,(z - 2)^2}.$$

7. Obtain all three canonical state variable models and realization for the transfer function *10*

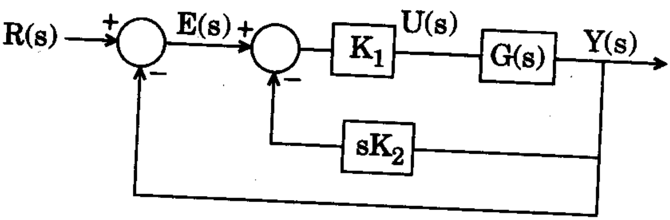
$$G(z) = \frac{Y(z)}{R(z)} = \frac{-2z^3 + 2z^2 - z + 2}{z^3 + z^2 - z - \frac{3}{4}}.$$

8. For the given block diagram

$$G(s) = \frac{100}{s^2} \text{ and } R(s) = \frac{1}{s}.$$

Determine the optimal values of parameters K_1 and K_2 such that

$$J = \int_0^\infty [e^2(t) + 0{\cdot}25\, u^2(t)]\, dt \quad \text{is minimized.}$$ *10*



9. Write short notes on any *two* of the following : *2×5=10*

(a) Jury's Stability Criteria

(b) Problems in Optimal Digital Control

(c) Transient Response and Frequency Response