Code No: 157BE

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, February/March - 2022
DIGITAL CONTROL SYSTEMS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1. Explain clearly the configuration of basic digital control scheme with the help of a neat block diagram. State its advantages and disadvantages. [15]

2.a) State different types of sampling operations. Discuss the effects of sampling.
b) Show that the sampling frequency should be at least twice the maximum frequency contained in the input signal. [8+7]

3.a) Obtain the Z-transform of

$$f(t) = \frac{1}{a}\left(1 - e^{-at}\right)$$ where 'a' is a constant

b) Find the inverse z-transform of the following:

$$F(z) = \frac{z^2}{(z-0.2)(z-0.8)(z-1)^2}$$ [7+8]

4. State and explain Jury stability and analysis for the following characteristic equation. [15]

$$P(z) = z^3 - 0.2z^2 - 0.25z + 0.005 = 0$$

5. For the following discrete control system represented by

$$G(z) = \frac{z^{-1}\left(1 + z^{-1}\right)}{\left(1 + 0.5z^{-1}\right)\left(1 - 0.5z^{-1}\right)}$$

Obtain the state representation of the system in the observable canonical form. Also find its state transition matrix. [15]

6. State and explain second method of Lyapunov used in stability analysis of discrete time control systems. [15]

7. Consider the system: X (k+1) = G X (k) + H U (k), where

$$G = \begin{bmatrix} -0.16 & -1 \\ 0 & 1 \end{bmatrix}; \quad H = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

Determine a suitable state feedback gain matrix K such that the system will have the closed loop poles at Z =0.5± j 0.5 by using pole placement design technique. [15]

8. Explain the procedure of design of discrete output feedback controller for discrete time control systems. [15]

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