

Total No. of Questions : 6]

SEAT No. :

**P36**

[Total No. of Pages : 2

**APR-17/B.E./Insem. - 40**  
**B.E. (Electrical)**  
**DIGITAL CONTROL SYSTEMS**  
**(2012 Pattern) (Elective - III (c))**

*Time : 1 Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) *Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6.*
- 2) *Neat diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables, electronic pocket calculator is allowed.*
- 5) *Assume suitable data, if necessary*

**Q1) a)** Check whether the following systems are **[5]**

- i) Static or Dynamic
- ii) Linear or non-Linear
- iii) Time invariant or Time variant
- 1)  $Y(n) = e^{x(n)}$                       2)  $Y(n) = x(2n)$

b) Explain frequency domain characteristics of first order hold. **[5]**

OR

**Q2) a)** For a given sequence:  $x(n) = \{4, 3, 0, 1, 2\}$  **[5]**

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- i) Delay the sequence by 3 samples.
  - ii) Fold & advance the sequence by 2 samples.
  - iii) Downscale the sequence by time 2 samples.
  - iv) Up-scale the sequence by amplitude scales.
  - v) Carry out amplitude downscaling.

b) Explain with neat diagram the various standard discrete test signals used in digital control system. **[5]**

**Q3) a)** Show how a mapping of left half of the S-plane is done into the Z-plane. **[5]**

b) Examine the stability of the system by Bilinear transformation method, whose characteristics equation is

$$F(z) = Z^3 - 1.3Z^2 - 0.08Z + 0.24 = 0 \quad \text{[5]}$$

OR

**P.T.O.**

- Q4)** a) Explain Bilinear Transformation & its use in stability investigation of discrete time system. [5]  
b) Describe design procedure of digital lead compensator using bode plot for discrete time system. [5]

- Q5)** a) Derive the solution of a non-Homogeneous state equation of a discrete time system from first Principles. [5]  
b) Using Cayley-Hamilton Theorem obtain the state transition matrix of the discrete time system. [5]

$$x(k+1) = \begin{pmatrix} 1 & -1 \\ 0 & 2 \end{pmatrix} x(k), \text{ Take } x(0) = \begin{pmatrix} 1 \\ -1 \end{pmatrix}$$

OR

- Q6)** a) Consider the system defined by [5]

$$\frac{Y(z)}{U(z)} = \frac{3z^2 - 11z}{z^3 - 6z^2 + 11z - 6}$$

Determine State space representation in Controllable canonical form.

- b) Discuss the various methods used for STM. [5]

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