

**ET505M / SIGNAL1 - Digital Signal Processing**

P. Pages : 2

Time : Three Hours



**GUG/S/25/13926**

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
  2. Assume suitable data wherever necessary.
  3. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) What do you understand by the terms: signal and signal processing? Discuss in details the block diagram of digital signal processing. **8**
- b) Determine the values of power and energy of the following signals. Find Whether the signals are power, Energy or neither energy nor power signals. **8**
- i)  $x(n) = \sin\left(\frac{\pi}{4}n\right)$
- ii)  $x(n) = e^{2n}u(n)$

**OR**

2. a) Discuss the following classification of discrete time signals. **8**
- i) Linear and Non-linear
- ii) Stable and unstable system.
- iii) Causal and Non-Causal system.
- iv) Time – Variant and time – Invariant system.
- b) Compute the 8-point discrete Fourier Transform of the sequence. **8**
- $x(n) = \{1, 1, 1, 1, 1, 1, 0, 0\}$
3. a) Define the term Z-transform, Discuss in details the concept of Region of convergence (ROC) along with suitable example. **8**
- b) Find the inverse Z-transform of the following if  $X(Z) = \frac{Z^2}{(Z-1)(Z-\frac{1}{2})}$ ; ROC  $|Z| > 1$  **8**

**OR**

4. a) Find the output of  $y(n)$  of the LTI-PT system given as: **8**
- $y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = 2x(n) + \frac{3}{2}x(n-1)$
- with initial conditions given as  $y(-1) = 0$ ,  $y(-2) = 1$ , and  $x(-1) = 0$  with input
- $x(n) = \left(\frac{1}{4}\right)^n x(n)$
- b) Find the Z-transform of the following signal  $x(z)$  if  $x(u) = -\alpha^n u(-n-1)$  **8**

5. a) Discuss the comparison between FIR and IIR Filters. 8
- b) Give direct Form-I and direct Form-II structure of second order system realization. 8

**OR**

6. a) Derive the expression for rounding and truncation errors. 8
- b) Discuss in details the Warping effect and pre Warping effect. 8
7. a) For the Analog transfer function 8
- $$H(s) = \frac{2}{(s+1)(s+2)}$$
- ; determine  $H(z)$  using impulse invariance method. Assume  $T = 1$  sec.
- b) What is Bilinear transformation? What are the properties of the Bilinear transformation? Discuss along with suitable examples. 8

**OR**

8. a) Give an Analog filter whose transfer function is  $H(s) = \frac{10}{s+10}$ ; convert it to the digital filter transfer function by using Bilinear transformation. Use  $T = 0.01$ sec. 8
- b) Discuss in details finite word Length effects in digital filters. 8
9. a) Describe in details Quadrature Mirror Filter (QMF) Bank. 8
- b) Elaborate Implementation of digital filter bank. 8

**OR**

10. a) What is the need for anti-imaging filter after up sampling a signal? Explain along with suitable example. 8
- b) What is multi rate signal processing? Elaborate along with suitable example. 8

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