

## 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 Weather 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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