B.E. Information Technology Sixth Semester

IT603 – Digital Signal Processing

P. Pages : 3 **GUG/W/18/1704**

Time : Three Hours * 1 3 3 8 * Max. Marks : 80

Notes : 1. Same Answer book must be used for all questions.
2. All questions carry marks as indicated.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Retain the construction lines.
6. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Represent the following signal using graphical and functional representation. **4**

i) $x(n)=\left\{2,-1,3,\underset{\uparrow}{1},-2,4,0,-3,2\right\}$

ii) $x(n)=\left\{-3,2,-1,0,\underset{\uparrow}{1},2,3\right\}$

b) Plot the standard signals as given below. **4**

i) Unit step signal u(n).
ii) Unit ramp signal $\mu_r(n)$.
iii) ASinwn.

c) Given sequence x(n), perform the given operations. **8**

$$x(n)=\left\{2,2,\underset{\uparrow}{3},1,1\right\}$$

i) $x(n-1)$, ii) $x(n+2)$,

iii) $x(-n)$, iv) $x(2n)$

OR

2. a) Perform the convolution of given sequence by using analytical method. **8**

$$x(n)=\left\{1,\underset{\uparrow}{2},2\right\}$$

$$h(n)=\left\{-1,2,\underset{\uparrow}{1},3\right\}$$

b) The analog signal given below is sampled by 600 samples per second. **8**

$$x(t)=2\sin 480\pi t+3\sin 729\pi t$$

Calculate :
i) Nyquist sampling rate
ii) Maximum frequency
iii) What are frequencies in radians in the resulting discrete signal x(n).

3. a) Find circular convolution of two sequence **8**

$$x_1(n)=\{1,3,5,3\},\ x_2(n)=\{2,3,1,1\}$$

b) Find DFT of the sequence **8**

$$x(n)=\left\{\underset{\uparrow}{1},2,3,4,3,2,1,0\right\}$$

OR

4. a) Find IDFT of **8**

$$X(k)=\{6,\ -2+2j,\ -2,\ -2-2j\}$$

b) Find the DFT using matrix method. **8**

$$x(n)=\{1,2,2,1\}$$

5. a) Determine the one-sided z-transform of following signal : **6**

i) $x(n)=\left\{1,2,\underset{\uparrow}{5},7,0,1\right\}$

ii) $x(n)=\left\{\underset{\uparrow}{0},1,2,7,3,2\right\}$

iii) $x(n)=\left\{-1,2,3,-2,0,\underset{\uparrow}{1}\right\}$

b) If $x(n)=(\sin w_o n)(\mu(n))$, find its z-transform and ROC. **6**

c) Explain region of convergence and give its any four properties. **4**

OR

6. a) Define z-transform and Inverse z-transform of discrete time signal and Give statements for any four properties of z-transform. **5**

b) Give the expression for **5**

i) Time reversal property.

ii) Time shift property of z-transform.

c) Find Inverse z-transform of **6**

$$x(z)=\frac{1}{1-z^{-1}+0.5z^{-2}}$$

7. Consider a causal LTI system whose system function is **16**

$$H(z)=\frac{1-\frac{2}{3}z^{-1}}{1-\frac{7}{8}z^{-1}+\frac{3}{32}z^{-2}}$$

Draw the block diagram representation and signal flow graphs for the implementations of the system in each of the following forms :-

i) Direct form – I

ii) Direct form – II

iii) Cascade form.

OR

8. a) Determine second order butterworth band pass filter that meet following specification **12**
Lower cut off frequency = 210 Hz
Upper cut off frequency = 330 Hz
Sampling frequency = 960 sample per second.

b) What are the advantages of windowing method of FIR design. **4**

9. a) Write a short note on, "why the FFT is preferred over DFT"? **4**

b) Find the FFT of the sequence **12**

$$x(n) = \left\{ \underset{\uparrow}{1}, 2, -3, 0, 4, 2, 1, 3 \right\}$$

using Decimation in time (DIT) algorithm.

OR

10. a) Find FFT for the sequence **12**

$$x(n) = \{ 4, 1, 3, -2, 0, -4, 1, 2 \}$$

using decimation in frequency algorithm.

b) Write short note on discrete cosine transform. **4**

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