6TH SEM./ AE & IE/ ELE. AND ETC./EE(I&C)./ ETC & COMM./ E&TC/ 2024(S)

Th- 3 Digital Signal Processing

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

   a. What are energy & power signals?

   b. Check whether the signal x(n)= u(n)- u(n-1) is causal or noncausal.

   c. Define ROC. Write any two properties of ROC.

   d. Define unit step and unit ramp signal (in discrete time domain)

   e. Find the Time period of the signal x(n)= $\sin(\frac{6\pi n}{7})$

   f. What is the difference between Causal system & Non-Causal system.

   g. Find the Z-transform of unit impulse signal.

   h. What are the various methods of finding inverse Z- transform.

   i. What are the applications of circular convolution.

   j. What is FFT? Is it a transform?

2. Answer **Any Six** Questions 6 x 5

   a. Determine the energy & power of the given sequence
   x(n)= $(½)^n u(n)$

   b. Check for
   (i) Linearity
   (ii) Time invariance
   Of the system given by:y(n)= x(n)+ n x(n-1) where x(n) & y(n) are input and output of the system respectively.

   c. State any 5 properties of Z- transform

   d. Compute poles, zeros and system response of the given difference equation y(n)= 2y(n-1) + 3x(n)

   e. Find the inverse Z-transform of $X(Z)=\frac{3Z}{(Z-1)(Z-2)}$ (ROC: $|Z| > 2$)

   f. Differentiate between linear & Circular convolution.

   g. Find 4 point IDFT of a sequence X(K)= {1,0,0,1}

3. Determine the response of the relaxed system characterized by the impulse response h(n)= $(1/2)^n$ u(n) to the input signal x(n) = 2^n u(n). 10

4. Find the system function & impulse response of the system described by the difference equation y(n)= $x(n) + 2x(n-1)$ 10

5. i) Find the 4 point DFT of the sequence x(n)= {1,0,2,1} [5]
   ii) Write down any 5 properties of DFT. [5]

6. Classify different discrete time systems with example. [10]

7. i) State and explain sampling theorem. [5]
   ii) Determine the Nyquist rate of the analog signal given by [5]
   m(t)= 2cos (100πt).sin(100πt).