6TH SEM ./ AE & IE/ELE. & ETC/ EE(I & C)/ ETC & COMM./E&TC/2023(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. State Sampling Theorem.

b. Draw the following type of signals. (i)Continuous aperiodic signal (ii) Discrete periodic signal

c. Define a causal signal and causal system.

d. Draw a discrete time unit step signal and ramp signal and represent them mathematically.

e. Determine z-transform of signal **y (n) = 3^n u(n).**

f. An input signal x(n) is applied to a LTI system having impulse response h(n),then write the expression for the output of the system.

g. Find the inverse z-transform of **X (Z) =**$\left(\frac{z}{z-2}\right)$ **(ROC: |Z| >2).**

h. Define ROC.

i. List any two types of digital filters.

j. State any two applications of FFT algorithm.

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

a. Explain different steps of analog to digital signal conversion process.

b. A causal LTI system is described by the difference equation

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = 2x(n)$$

Determine impulse response, $h(n)$ of the system.

c. Write down the advantages of Digital Signal Processing over analog signal processing.

d. State and explain any five properties of DFT.

e. Let $x(n) = \delta(n) + 3\delta(n-1) - 2\delta(n-3)$ and h$(n) = 2\delta(n+1) + \delta(n) - 4\delta(n-1)$. Compute and plot $y(n) = x(n) * h(n)$

f. Find 4-point DFT of x(n) = {1, 0, 1, 0}

g Find energy (E) and average power (P) of $x(n) = \left(\frac{1}{2}\right)^n u(n)$.

3 With a neat block diagram explain different parts of digital to analog converter. 10

4 (i) Define LTI system. [1] 10

(ii) Determine whether the following systems are linear time invariant.[9]

(a) y(n) = nx(n-4) (b) $y(n) = e^{x(n)}$ (c) y(n)=x(n)-x(n-1)

5 Consider the z – transform $X(Z) = \frac{3-\frac{5}{6}z^{-1}}{\left(1-\frac{1}{4}z^{-1}\right)\left(1-\frac{1}{3}z^{-1}\right)}$ with $ROC: \frac{1}{4} < |x| < \frac{1}{3}$. 10

Determine its inverse z – transform.

6 (i) Differentiate between FIR and IIR filters. [5] 10

(ii) Determine circular convolution of the following sequences. [5]

$$g(n) = \{1, 2, 0, 1\} \; and \; h(n) = \{2, 2, 1, 1\}$$

7 Determine 8-point DFT of a sequence $x(n) = \{1, \; 2, 3, 0, 2, 1, 0, 4\}$using radix –2 DIT FFT algorithm. 10