R18 Regulation *Subject code: 2P5DC*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech V Semester Regular/Supplementary Examinations, December 2021

DIGITAL SIGNAL PROCESSING

(Electronics and Communication Engineering)

Maximum Marks: 70 ***Date:05.01.2022*** Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 Formulate whether the given system described by the equation y[n]=nx[n] is linear

2 Determine the Nyquist rate and Nyquist sampling interval for the signal $x(t)=\sin(200\pi t) + \sin(300\pi t)$

3 Given two sequences of length N=4 defined by x[n] = {1, 2, 2, 1} and h[n] = {2, 1, 1, 2}, determine the Linear convolution.

4 How many multiplications and additions are required to compute 16-Point DFT using radix -2 FFT?

5 Find the digital transfer function H(z) by using bilinear for the analog transfer function $H(s) = \frac{1}{s+2}$ Assume T = 1 sec.

6 Why impulse invariant method is not preferred in the design of IIR filter other than low pass filter?

7 Define phase delay and group delay.

8 State the Differences between FIR and IIR filters.

9 If the spectrum of a sequence *x(n)* is $X(e^{j\omega})$, then what is the spectrum of the signal down sampled by 2 ?

10 What is the effect of quantization on pole locations?

Part-B

Answer All the following questions. (5X10M=50Marks)

11 For the following systems. (10M)

(a) $y(n) = x(n) + \frac{1}{x(n-1)}$

(b) $y(n) = x(n) + x(n-1)$

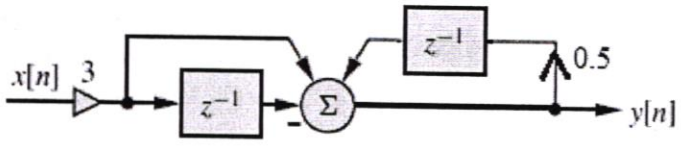
(c) $y(n) = x(n^2)$

(d) $y(n) = x(-n)$

Invent whether the systems are static/dynamic, linear/non-linear, time invariant or time-variant, causal or non-causal

OR

12 Consider the LTI system shown in Fig. (10M)



(a) Determine the standard delay-form difference equation description of this system.
(b) Determine the impulse response $h[n]$ of this system.
(c) Is this system stable and causal? Explain.
(d)Determine the output y[n] when input is unit step.

13 Find the output y[n] of a filter whose impulse response is h[n] = {1, 1, 1} and input signal is x[n] = {3, -1, 0, 1, 3, 2, 0, 1, 2, 1} using (i) Overlap save method and (ii) Overlap add method. (10M)

OR

14 Examine the 8-point DFT of the sequence (n) = {2,2,2,2,1,1,1,1} using decimation in time FFT algorithm. Also sketch the magnitude spectrum. (10M)

15 Apply Bilinear transformation to determine (z) for Butterworth filter satisfying the following specifications. (10M)

$$0.7 \le |H(e^{j\omega})| \le 1 \qquad 0 \le \omega \le \pi/4$$
$$|H(e^{j\omega})| \le 0.2 \qquad \omega \le \pi$$

OR

16 Design a digital chebyshev filter to meet the constraints. (10M)

$$\frac{1}{\sqrt{2}} \le |H(e^{j\omega})| \le 1 \quad 0 \le \omega \le 0.2\pi$$
$$|H(e^{j\omega})| \le 0.1 \quad 0.5\pi \le \omega \le \pi$$

By using bilinear transformation and assume sampling period T=1sec

17 For the desired response $H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega} & -\frac{\pi}{8} \le \omega \le \frac{\pi}{8} \\ 0 & \frac{\pi}{8} < |\omega| \le \pi \end{cases}$, Determine the desired Impulse response $h_d(n)$ and filter coefficients h(n) of the FIR filter using hanning window for N=7. (10M)

OR

18 Determine the coefficients of a linear phase FIR filter of length M=15 has a symmetric unit sample response and a frequency response that satisfies the conditions. (10M)

$$H(\tfrac{2\pi k}{15}) = \begin{cases} 1 & k = 0,1,2,3 \\ 0 & k = 4,5,6,7 \end{cases}$$

19 Analyze the decimation process by a factor D and derive the input-output relationship in between both time and frequency domain. (10M)

OR

20 Explain the characteristics of Limit cycle oscillations with respect to the system described by the differential equations. y(n)=0.95y(n-1)+x(n) and determine the dead band of the filter. (10M)