R18 Regulation *Subject code: 2E5BC*

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
(Electrical and Electronics Engineering)

Maximum Marks: 70 ***Date:07.01.2022*** 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 Determine if the system described by the following equation, is a linear system.
$$y[n] = x[n] + 2x[n^2]$$

2 Find $X(Z)$ if $x[n] = u[n-1]$

3 State and prove time shifting property of DFT.

4 Find circular convolution of
$x_1[n] = \{1, -2, 1\} \& x_2[n] = \{2, -1\}$.

5 What are the characteristics of Chebyshev filter?

6 What is warping?

7 What is Gibb's phenomenon?

8 For the FIR filter with impulse response $h[n] = \{2, 3, -1, 5, -1, 3, 2\}$, draw the linear phase filter structure.

9 What is interpolation?

10 What is dead band of a filter?

Part-B

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

11 a) Explain the DSP block diagram and write its applications.
b) State and prove differentiation property of Z transform. [5+5]

OR

12 Find response of the system described by the difference equation
$y[n] = 2x[n] - y[n-1] + 12y[n-2]$ to the input $x[n] = \left(\frac{1}{2}\right)^n u[n]$, if $y[-2] = 0$ and $y[-1] = 1$. [10]

13 a) Find circular convolution of $x_1[n] = \{1, -2, 2, -1\}$ and $x_2[n] = \{1, -2, 3, -4\}$ using DFT.
b) Derive radix 2 DIT FFT algorithm. [5+5]

OR

14 Find IDFT using DIT FFT
$X(K) = \{12, -1.5 + j2.598, -1.5 + j0.866, 0, -1.5 - j0.866, -1.5 - j2.598\}$ [10]

15 Design a Butterworth filter using impulse invariance method for the following specifications:

$0.8 \leq |H(e^{j\omega})| \leq 1$ for $0 \leq |\omega| \leq 0.2\pi$

$|H(e^{j\omega})| \leq 0.2$ for $0.6\pi \leq |\omega| < \pi$ [10]

OR

16 Design a Chebyshev filter using Bilinear transformation method for the following specifications:

$0.8 \leq |H(e^{j\omega})| \leq 1$ for $0 \leq |\omega| \leq 0.3\pi$

$|H(e^{j\omega})| \leq 0.2$ for $0.7\pi \leq |\omega| < \pi$ [10]

17 Design a FIR low pass digital filter using frequency sampling method for the following specification:

Cut off frequency: 1500Hz
Sampling frequency: 15000Hz
Order of the filter N: 10
Required filter length L: N+1 [10]

OR

18 Design an ideal FIR filter for the specifications given below

$|H(e^{j\omega})| = 1$ for $\frac{\pi}{3} \leq |\omega| \leq \frac{2\pi}{3}$

$= 0$ for $|\omega| < \frac{\pi}{3}$ and $\frac{2\pi}{3} < |\omega| \leq \pi$

for N=9 using Hanning window. [10]

19 Explain the characteristics of a limit cycle oscillation with respect to the system described by the equation

$y[n] = 0.85y[n-2] + 0.72y[n-1] + x[n]$.

Determine the dead band of the filter $x[n] = \frac{3}{4}\delta[n]$ for b = 4. [10]

OR

20 With the help of an equation explain in detail sampling rate conversion by a rational factor $\frac{I}{D}$. [10M]