R18 Regulation ***Subject code:*** 2E5BC

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.TechV Semester Regular Examinations, February 2021

Digital Signal Processing

(Electrical and Electronics Engineering)

Maximum Marks: 70 Date: 24.02.2021 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 What are linear shift invariant systems?
2 Find the Z transform of x[n], if x[n] = u[n].
3 State and prove periodicity property of DFT.
4 Determine the spectra or the Fourier Series Coefficient of the signal $x[n] = Cos\frac{\pi n}{3}$
5 List the differences between Butterworth and Chebyshev filters.
6 What are the limitations of Impulse invariant technique?
7 What is Gibbs's phenomenon associated with FIR filters?
8 What are the advantages of FIR filters as compared to IIR filters?
9 What is Zero input limit cycle oscillation?
10 What is Decimation?

Part-B

Answer All the following questions. **(10M X 5=50Marks)**

11 For the system described by the difference equation
$y[n] = -0.2y[n-1] + 0.48y[n-2] + x[n] + x[n-1]$, if y[-1] = 1 and y[-2]=0
a) Determine system function and the impulse response.(5M)
b) Plot the poles and zeros and determine if the system is stable.(5M)

OR

12 For the system described by the difference equation
$y[n] = -0.6y[n-1] + 0.4y[n-2]$
a) Find the step response.(5M)
b) Find the response to the input$x[n] = \left(\frac{1}{3}\right)^n u[n]$. (5M)

13 A, Find DFT of $x[n] = \{1,\ 2, -3, -1, -2, 0, 2, 3\}$ using Over-lap Save method (5M)
B. Explain Linear convolution property of DFT.(5M)

OR

14 A. Derive the algorithm for Decimation in Frequency radix-2 FFT. (5M)
B. Determine Inverse DFT of $X(K) = \{8, 1-j, 2+j, -j, 2, j, 2-j, 1+j\}$ using the above algorithm. (5M)

15 Using Bilinear transformation design a high pass filter, monotonic in passband and stop band with passband frequency of 1KHz at 2.4dB and down to 10dB at 330 Hz. The sampling frequency is 5KHz. (10M)

OR

16 Design a Chebyshev filter with the following specifications: maximum passband attenuation of 2.5dB at Ω_p= 20rad/sec and stopband attenuation of 30dB at Ω_s=50rad/sec. (10M)

17 Determine the coefficients of a linear phase FIR filter of length M = 11 which has a symmetric unit sample response and a frequency response that satisfies the conditions

$$H_r\left(\frac{2\pi k}{11}\right) = \begin{cases} 1, \ for\ k = 0,1,2 \\ 0.4, \quad for\ k = 3 \\ 0, \ for \ \ k = 4,5 \end{cases}$$

using Frequency sampling method. (10M)

OR

18 Design an FIR linear phase, digital filter approximating the ideal frequency response

$$H_d(\omega) = \begin{cases} 1, \ for|\omega| \le \frac{\pi}{6} \\ 0, \ for\ \frac{\pi}{6} < |\omega| < \pi \end{cases}$$

for M=13, using Hamming window. (10M)

19 Explain the characteristics of Limit cycle oscillations representing the system describedby the difference equation $y[n] = 0.95y[n-1] + x[n]$. Determine the dead band of the filter. (10M)

OR

20 A. Explain multistage implementation of sampling rate conversion with block diagram. (5M)

B. Signal x[n] is represented by $x[n] = \{0, 1, 2, 3, 4, 5, 6, 0, 1, 2, 3 \ldots \ldots\}$.

i. Obtain decimated signal by a factor 2

ii. Obtain interpolated signal by a factor 2 (5M)