R18 Regulation *Subject code:* 2P5DC

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech V Semester Regular Examinations, February 2021

DIGITAL SIGNAL PROCESSING

(Electronics and Communication Engineering)

Maximum Marks: 70 Date: 22.02.2021 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 Define energy and power signal.
2 List out the applications of Digital Signal Processing.
3 Define Zero padding.
4 Differentiate DTFT and DFT. How many multiplication terms are required for doing DFT by expressional method and FFT method?
5 Compare IIR and FIR filters.
6 What is warping effect?
7 What is mean by FIR filter?Write the methods involved in FIR filter design.
8 What condition on the FIR sequence h(n) are to be imposed in order that this filter can be called a liner phase filter?
9 Define Up Sampling and Down Sampling.
10 Define Round off Noise and Overflow Noise.

Part-B

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

11 a) Obtain the relation between DTFT & Z-transform. (5M)

b) Obtain the direct form I and parallel form realization for the system

$$y(n)= -0.1\, y(n-1)+ 0.2\, y(n-2)+ 3x(n)+ 3.6x(n-1)+ 0.6\, x(n-2) \quad (5M)$$

OR

12 a) Determine if the following systems are time variant or time invariant. (5M)
i) $y(n)= x(n)+x(n-1)$ ii) $y(n)=x(-n)$
b) Determine if the system described by the following equation are causal or non-causal
i) $y(n)= x(n)+(1/x(n-1))$ ii) $y(n)=x(n^2)$ (5M)

13 Compute Inverse FFT of the sequence

$X(K)=\{ 7,-0.707-j0.707,-j, 0.707-j0.707,1, 0.707+j0.707,j, -0.707+j0.707\}$ (10M)

OR

14 Compute the eight-point DFT of the sequence

$$x(n)=\begin{cases}1, & 0 \le n \le 7 \\ 0, & otherwise\end{cases}$$ (10M)

15 a) Convert the following analog transfer function into digital using impulse invariant mapping with T = 1 sec. H(s) = 3/[(s+3)(s+5)] (5M)

b) Design a low pass Butterworth digital filter with the following specification :
Ω_s = 600 rad/sec, Ω_p = 200 rad/sec
α_p = 1 dB, α_S = 30 dB (5M)

OR

16 a) Explain the procedure for designing analog filters using the chebyshev approximation. (5M)
b) Design a digital butterworth filter using Bilinear Transformation method satisfying the constraints. Assume T = 1 sec.

$0.8 \le |H(ej\omega)| \le 1$ for $0 \le \omega \le 0.2\pi$
$|H(ej\omega)| \le 0.2$ for $0.6\pi \le \omega \le \pi$ (5M)

17 a) Discuss the design procedure for FIR filter using Fourier series method. (5M)

b) Design an ideal high pass filter with a frequency response

$H_d(e^{j\omega}) = 1$ for $\pi/4 \le \omega \le \pi$
$= 0$ for $\omega \le \pi/4$

Find the values of h(n) for N =11 using hamming window. Find H (z). (5M)

OR

18 a) Explain with neat sketches the implementation of FIR filters in the (10M)
i) direct form ii) cascade form

19 a) What is decimation and interpolation? Explain briefly with suitable sketches. (5M)
b) Find the Z- transform of $a^n u(n)$ upsampled by a factor 2. (5M)

OR

20 a) Explain the limit cycle oscillations due to product round off and overflow errors. (5M)
b) With the help of block diagram explain the sampling rate conversion by a rational factor `I/D'. Obtain necessary expressions. (5M)