Printed Pages – 6 Roll No. : .....

C028613(028)

B. Tech. (Sixth Semester) Examination, April-May 2022

(Scheme : AICTE)

(Electronics & Telecommunication Engineeing Branch)

DIGITAL SIGNAL PROCESSING

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. Part (a) of each question is compulsory and carries 4 marks. Attempt* ***two*** *parts from part (b), (c) and (d) carrying 8 marks each.*

Unit-I

1. (a) Define DTFT and IDTFT of a sequence $x(n)$.

(b) Compute circular periodic convolutions of the two sequences

$x_1(n) = \{1, 1, 2, 2\}$ and $x_2(n) = \{1, 2, 3, 4\}$

(c) Given $x(n)=\{0, 1, 2, 3, 4, 5, 6, 7\}$, find $x(k)$ using DIT FFT algorithm.

(d) Given $x(n)=\{1, 2, 3, 4, 4, 3, 2, 1\}$, find $X(K)$ using DIF FFT algorithm.

Unit-II

2. (a) Describe finite impulse response.

(b) Relize the IIR filter

$$H(z)=\frac{2+8z^{-1}+6z^{-2}}{1+8z^{-1}+12z^{-2}}$$

using ladder structure.

(c) Obtain the cascade and parallel realization for the system function given by

$$H(z)=\frac{1+\frac{1}{4}z^{-1}}{\left(1+\frac{1}{2}z^{-1}\right)\left(1+\frac{1}{2}z^{-1}+\frac{1}{4}z^{-2}\right)}$$

(d) Obtain direct form and cascade form realization for the transfer function of an FIR system given by

$$H(z)=\left(1-\frac{1}{4}z^{-1}+\frac{3}{8}z^{-2}\right)\left(1-\frac{1}{8}z^{-1}-\frac{1}{2}z^{-2}\right)$$

Unit-III

3. (a) What do you understand by linear phase response?

(b) Express the process of windowing using illustration.

(c) A filter is to be designed with the following desired fequency response

$$H_d(e^{jw})=\begin{cases}0 & -\pi/4<w<\pi/4\\ e^{-2jw} & \pi/4\le|w|\le\pi\end{cases}$$

Determine the filter coefficient $H_d(n)$ if the window function is defined as

$$w(n)=\begin{cases}1 & 0\le n\le 4\\ 0 & \text{otherwise}\end{cases}$$

also, determine the frequency response $H(e^{jw})$ of the designed filter.

(d) Design a filter with

$$H_d(e^{jw})=\begin{cases}e^{-3jw}, & -\pi/4\le w\le\pi/4\\ 0, & \pi/4<|w|\le\pi\end{cases}$$

using Hamming window with M = 7.

Unit-IV

4. (a) Use the backward difference for the derivative to convert the analog low-pass filter with system function

$$H(s)=\frac{1}{s+2}$$

(b) Convert the analog filter into a digital filter whose system function is

$$H(s)=\frac{s+0\cdot 2}{(s+0\cdot 2)^2+9}$$

using impulse invariance technique. Assume $T=1$ sec.

(c) Design a Butterworth filter using the impulse invariance method for following specification

$$0\cdot 8\le\left|H\left(e^{jw}\right)\right|\le 1 \qquad 0\le w\le 0\cdot 2\pi$$

$$\left|H\left(e^{jw}\right)\right|\le 0\cdot 2 \quad 0\cdot 6\pi\le w\le\pi$$

(d) Design a digital Chebyshev filter to satisfy the constraints using Bilinear transformation and $T=1$ sec

$$0\cdot 707\le\left|H\left(e^{jw}\right)\right|\le 1 \qquad 0\le w\le 0\cdot 2\pi$$

$$\left|H\left(e^{jw}\right)\right|\le 0\cdot 1 \quad 0\cdot 5\pi\le w\le\pi$$

Unit-V

5. (a) What are the advantages of MDSP?

(b) Explain the process of decimation with example.

(c) Consider the figure below. The input to the system is given as

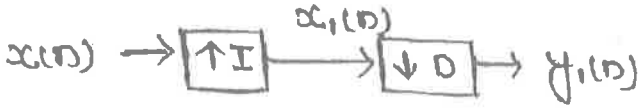

Fig (a)

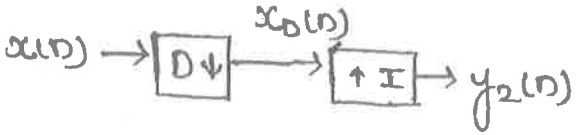

Fig (b)

$$x(n)=\{1, 3, 2, 5, -1, -2, 2, 3, 2, 1, \ldots\ldots\}$$

(i) If $D=4$ and $I=2$ show that outputs of the two configuration are different.

(ii) If $D=3$ and $I=2$ show that two system are identical

(d) A multirate system is shown in figure. Find the relation between $x(n)$ and $y(n)$.