R18

Code No: 157BG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, February/March - 2022
DIGITAL SIGNAL PROCESSING
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any Five Questions
All Questions Carry Equal Marks
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1.a) Check whether following systems are linear, causal, time invariant, stable, static
$y(n) = x(n) \cos(x(n))$

b) Explain in detail about conversion of analog signal to digital signal with suitable block diagram and also explain about reconstructing the signal from its samples. [7+8]

2.a) Consider causal and stable LTI system whose I/Ps and O/Ps are related through second order difference equation $y(n)-(1/6)\ y(n-1)-(1/6)y(n-2)=x(n)$, determine system impulse response h(n) for the system.

b) Describe the decimation process with a factor of 'M'. Obtain necessary expression and sketch frequency response. Also discuss aliasing effect. [7+8]

3.a) Prove the following properties of DFT when H(K) is the DFT of an N-point sequence h(n)
i) H(K) is real and even when h(n) is real and even.
ii) H(K) is imaginary and odd when h(n) is real and odd.

b) Two finite duration sequence are given by $x(n) = \sin(n\pi/2)$ for n = 0,1,2,3 and h(n) = 2n for n = 0,1,2,3. Determine circular convolution using DFT & IDFT method. [8+7]

4.a) State and prove the properties of Discrete Fourier Transform.

b) Compute IDFT of the sequence
x(n) = { 7, -0.707-j0.707, -j, 0.707-j0.707, 1, 0.707+j0.707,j, -0.707+j0.707} using FFT algorithm. [7+8]

5.a) Determine system function H(z) for a Butterworth filter using Bilinear transformation for the constraints

$$0.8 \le |H(e^{j\omega})| \le 1,\ 0 \le \omega \le 0.2\pi$$
$$|H(e^{j\omega})| \le 0.2,\ 0.6\pi \le \omega \le \pi \text{ with T= 1 sec.}$$

b) Discuss the location of poles for Chebyshev filter. [8+7]

6.a) Discuss in detail about Butterworth filter. What is the effect of varying order of N on magnitude and phase response?

b) The specifications of desired low pass filter is

$$0.8 \le |H(\omega)| \le 1.0\ ;\ 0 \le \omega \le 0.2\pi$$
$$|H(\omega)| \le 0.2\ ;\ 0.6\pi \le \omega \le \pi$$

Design a Chebyshev digital filter using impulse invariant Transformation. [8+7]

7.a) Determine the filter coefficients of h(n) of length M=15 obtained by sampling method with its frequency response as

$$H(2\pi K/15) = 1 \quad ; K=0,1,2,3,4$$
$$= 0.4 \quad ; K=5$$
$$= 0 \quad ; K=6,7$$

b) Design a HPF of length 8 with cut off frequency of 4 rad/sec using Hamming window. Plot the magnitude and phase response. [7+8]

8.a) What is the need for signal scaling? How the overflow error scaling is performed?

b) Realize system with following difference equation

$y(n) = (3/4)\ y(n-1) - (1/8)\ y(n-2) + x(n) + (1/3)x(n-1)$ using Direct form-I and Direct form-II. [7+8]

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