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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22

Course Code: ECE3002

Course Name: Digital Signal Processing

Program & Sem: B.Tech & IV Sem

Date: 26th April 2022

Time: 03.00 PM to 04.00 PM

Max Marks: 30

Weightage: 15 %

Instructions:

(i) Read the all questions carefully and answer accordingly.

Part A [Memory Recall Questions]

Answer both the Questions. Each question carries 4 marks.

(2Qx 4M= 8M)

1. Sampling is the process of converting a continuous-time signal into discrete-time signal. State Sampling Theorem. [4M](C.O.No.1) [Knowledge]

2. Shifting the sequence in time domain by 'l' samples is equivalent to multiplying the sequence in frequency domain by the twiddle factor. State and prove this property of DFT.

[4M] (C.O.No.1) [Comprehension]

Part B [Thought Provoking Questions]

Answer the Question. The question carries 10 marks.

(1Qx10M=10M)

3. If $x(n)$ is a sequence of L number of samples and $h(n)$ with M samples, after convolution $y(n)$ will contain $N=\text{Max}(L, M)$ samples. Use graphical method (concentric method) obtain 5 point circular convolution of two DFT signal defined as,

$$x_1(n) = (1.5)^n; 0 \leq n \leq 2$$

$$x_2(n) = (2n-3); 0 \leq n \leq 3$$

[10M](C.O.No.2) [Comprehension]

Part C [Problem Solving Questions]

Answer the Question. The question carries 12 marks.

(1Qx12M=12M)

4. In DFT, sampling is done in frequency domain, where periodic continuous signal of spectrum(DTFT) is sampled to get discrete values of spectrum, which results in periodicity in time domain. Compute the 4-point DFT of the given sequence $x(n) = \{0,1,2,3\}$ and verify the result with IDFT method using formula expansion method. [12M] (C.O.No. 1) [Comprehension]



**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 2

Winter Semester: 2021 - 22

Course Code: ECE 3002

Course Name: Digital Signal Processing

Programme & Sem: B.Tech (ECE) & IV Semester

Date: 1st June 2022

Time: 03.000 PM to 04.00 PM

Max Marks: 30

Weightage: 15%

Instructions:

- (i) *Read Questions carefully and answer accordingly*
- (ii) *All Questions are compulsory*

Part A [Memory Recall Questions]

Answer both the Questions. Each question carries four marks. (2Qx4=8M)

1. Convolution of long input sequence by traditional methods has many demerits. Explain some of the demerits of the traditional techniques and mention the two ways through which convolution of long sequence can take place. Discuss the two methods in brief.

(CO-1)[Knowledge]

2. FFT was proposed to evaluate the spectral content of a signal in less time duration. There are two ways to find FFT for time domain input sample. Mention the two ways. Also write two similarities and two differences amongst them. Mention the number of stages required for N point FFT.

(CO-1)[Knowledge]

Part B [Thought Provoking Questions]

Answer the Questions. The question carries ten marks (1Qx10=10M)

3. Filters are designed to remove unwanted components from signal. There are two different kinds of filters i.e. Analog filters and Digital filters.

i) Discuss at-least two real time example of filters and mention two differences between an analog and digital filter. Comment on four types of filters based on pass-band and stop-band frequencies. Draw the transfer function of each.

(CO-2)[Comprehension]

ii) Rohan wants to design an analog low pass Butterworth filter for separating speech from music signal for his application. The filter should have a pass-band attenuation of 2dB at frequency of 20 rad/sec and at-least 10dB stop-band attenuation at 30 rad/sec. Design the filter for the given specification.

Part C [Problem Solving Questions]

Answer the Question. The question carries twelve marks

(1Qx12=12M)

4. DIT-FFT and DIF-FFT are two ways to find FFT. Find 4 point FFT using both DIT-FFT and DIF-FFT for $x(n) = \{0, 1, 2, 3\}$. Verify your results by finding IDFT using DIT-FFT method.



**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF MANAGEMENT

END TERM EXAMINATION

Winter Semester: 2021 - 22

Course Code: ECE3002

Course Name: DIGITAL SIGNAL PROCESSING

Program & Sem: ECE – IV Sem

Date: 28th June 2022

Time: 09:30 AM to 12:30 PM

Max Marks: 60

Weightage:30%

Instructions:

- (i) *Read the all questions carefully and answer accordingly.*
- (ii) *Scientific Calculators are allowed*

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TWO marks.

(4Qx 2M= 8M)

1. FIR filters have, and IIR filters have

- a. Zeros, zeros b. poles & zeros, Zeros
c. Zeros, poles & zeros d. none of above

(C.O.No.4) [Bloom's level: Knowledge]

2. Calculate DFT of $x(n) = \{1, 0, 1, 0\}$.

- a. $x(k) = \{2, 0, 2, 0\}$ b. $x(k) = \{1, 0, 1, 0\}$ c. $x(k) = \{2, 0, 1, 0\}$ d. none

(C.O.No.1) [Bloom's level: Comprehension]

3. The number of complex multiplication in computing N=64 point DFT using FFT is____.

- a. 4096 b. 192 c. 4032 d. none

(C.O.No.2) [Bloom's level: Comprehension]

4. Draw the butterfly diagram of 4pt DIT and DIF, FFT calculations.

(C.O.No.2) [Bloom's level: Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries EIGHT marks.

(2Qx8M=16M)

5. The difference equation of a filter is given as,

$y(n) = -0.1y(n-1) + 0.72y(n-2) + 0.7x(n) - 0.25x(n-2)$, Determine whether it is FIR filter or IIR filter, and realize the same using Direct Form-I and Direct Form-II structures.

(C.O.No.3) [Bloom's level: Comprehension]

6. Transform $H(s) = 1/(s^2 + s + 1)$, normalize butterworth LPF to a digital filter using Impulse Invariance transformation technique. The system uses sampling rate of 1Hz.

(C.O.No.3) [Bloom's level: Comprehension]

Part C [Problem Solving Questions]

Answer all the Questions. Each question carries TWELVE marks.

(3Qx12M=36M)

7. A FIR filter (low pass) is to be designed with a desired frequency response,

$$H_d(e^{j\omega}) = e^{-j3\omega}, \quad \frac{-3\pi}{4} \leq \omega \leq \frac{3\pi}{4}$$
$$= 0, \quad \frac{3\pi}{4} < |\omega| < \pi$$

Determine the filter coefficients $h_d(n)$ and $h(n)$. Use Rectangular window with $N=5$. Also obtain the frequency response.

(C.O.No.4) [Bloom's level: Comprehension]

8. Given the specifications $\alpha_p=3\text{dB}$; $\alpha_s=16\text{dB}$; $\Omega_p=2000\pi$ rad/sec and $\Omega_s=4000\pi$ rad/sec.

Determine the order and the poles of a type-1 low pass Chebyshev filter and calculate the transfer function of analog Low pass filter.

(C.O.No.3) [Bloom's level: Comprehension]

9. Find $y(n)$ for the given $x(n)$ and $h(n)$ by using the Overlap Add method

$$x(n) = \{1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 1\} \text{ and } h(n) = \{1, 2, 3\}$$

(C.O.No.1) [Bloom's level: Comprehension]