Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST –1

Winter Semester 2021 - 22
Course Code: ECE 213
Course Name: DIGITAL SIGNALPROCESSING
Program & Sem: BTech & VI Sem EEE

Date: 25 April 2022
Time: 01.30pm-02.30pm
Max Marks: 30
Weightage: 15%

Instructions:

(i) ***Read the question carefully and answer all the questions***

(ii) ***Scientific non-memory calculator permitted***

Part A [Memory Recall Questions]
Answer all the questions. Each question carries one mark. (5Qx 1M= 5M)

1. DSP-based devices have limited memory space and the ability to deal with large amounts of data. For large data convolution, we can use _____ method
(C.O.No.1)[Knowledge]

2. DFT is the Discrete Fourier Transform used for frequency analysis. And _____
   i. DFT is applicable if x(n) is a continuous time-periodic signal
   ii. DFT is applicable if x(n) is a discrete-time periodic signal
   iii. DFT is applicable if x(n) is a continuous-time finite-length signal
   iv. DFT is applicable if x(n) is discrete-time finite-length signal
(C.O.No.1)[Knowledge]

3. The response of an LTI system is a linear convolution for any two arbitrary input signals. For linear convolution, 1. The length of both sequences must be the same. 2. Output sequence length is more than input sequence length. Identify the true statement from the following, ((i).1 and 2 are correct (ii) 1 is correct (iii) 2 is correct (iv) 1and 2 are wrong) (C.O. No. 1)[Knowledge]

4. Circular Convolution and Linear convolution are related by the length N. Which of the following is FALSE
   i. Circular convolution is an aliased copy of linear convolution if length selected is less than N=L1 + L2 -1

ii. If we do Circular convolution with length N >= L1+L2-1 we can get the same answer as doing linear convolution
iii. IF x(n) has length =5 and h(n) has length 4 we can do circular convolution by selecting N=5
iv. IF x(n) has length =5 and h(n) has length 4 we can do Linear convolution by selecting N=5 (C.O.No.1)[Knowledge]

5. Exact reconstruction of a continuous-time signal from its samples is possible if the signal is band-limited and the sampling frequency is greater than twice the signal bandwidth". This statement is related to _____ (C.O. No. 1)[Knowledge]

Part B [Thought Provoking Questions]
Answer the following question. It carries SEVEN mark. (1Qx7M=7M)

6. Two persons x1 & x2 start from the same town for selling vegetables. At the starting point(origin), each person has five dollars with them. After one-hour salesperson x1, has sold his vegetable for five dollars but person x2 has seven dollars. At the end of the second hour sales period, person x1 has sold for 2 dollars when x2 has only one dollar. Similarly, for the third hour sales period both have only one dollar sales. Now they wish to consider the amount (what they have) according to the sales period as a discrete sequence representation. Further, they wish to show the cyclic amount (circular convolution) of sales as a discrete sequence. Please guide them to find the sequence.
(C.O. No. 1) [Application]

Part C [Problem Solving Questions]
Answer ANY TWO questions. Each question carries NINE mark (2Qx9M=18M)

7. A signal $x(t) = 10\sin 50\Pi t - 15\cos 100\Pi t + 2\cos 300\Pi t$ is sampled.
Determine Nyquist rate? (C.O.No.1)[Comprehension]

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

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

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

9. By using DFT and IDFT find the circular convolution for the given two sequences and verify your answer using the matrix method.
$x_1(n) = \{1 \quad 2 \quad 3 \quad 4\}$ $x_2(n) = \{1 \quad 0 \quad 1 \quad 0\}$ (C.O. No.1)[Comprehension]

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TEST 2

Semester	**:** WINTER SEMESTER	**Date:**	31st May 2022
Course Code	**:** ECE 213	**Time:**	01.30 PM to 02.30 PM
Course Name	**:** DIGITAL SIGNALPROCESSING	**Max Marks**	**:** 30
Program & Sem	**:** BTech & VI Sem EEE	**Weightage**	**:** 15%

Instructions:

(i) ***Read the question carefully and answer all the questions***

(ii) ***Scientific non-memory calculator permitted***

Part A [Memory Recall Questions]

Answer all the questions. Each question carries ONE mark. (5Qx 1M= 5M)

1. Decimation-in frequency FFT algorithm is used to compute_____ (C.O. No. 2)[Knowledge]
2. Define the twiddle factor (multiplication factor) value, if N=8, k=1, n=1 ____ (C.O. No. 2)[Knowledge]
3. How many complex multiplications are need to be performed for N-point FFT algorithm? (C.O. No. 2)[Knowledge]
4. How many complex multiplications are need to compute N point DFT using direct formula? (C.O. No. 2)[Knowledge]
5. X(k)={28, (-4+9.656j), _____ , (-4+1.656j), (-4), (-4-1.656j), (-4+4j), (-4-9.656j)} fill the blank. (C.O. No. 2)[Knowledge]

Part B [Thought Provoking Questions]

Answer the following question. It carries FIFTEEN marks. (1Qx15M=15M)

6. DFT is used whenever the signal needs to be processed in the frequency domain. A final year engineering student wants to compute 8-point DFT for the sequence x(n)=n+1. But he has a computing system that has very less memory space. So he planning to use some algorithm that may need less amount of memory and compute the result quickly. Guide him to compute the results. (C.O. No. 2) [Application]

Part C [Problem Solving Questions]

Answer both the questions. Each question carries TEN Marks. (2Qx10M=20M)

7. Using the Formula method, compute Discrete Fourier Transform for the given sequence [6M] (C.O.No.2)[Comprehension]

$$x(n) = \{0,1,2,3\}$$

8. For the given difference equation, obtain the Direct form II realization

$$H(z) = \frac{(1+5z^{-1})}{(1+2z^{-1}+3z^{-2})}$$ [4M] (C.O.No.3)[Comprehension]

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END TERM FINAL EXAMINATION

Semester	**:** WINTER SEMESTER	**Date**	**:** 28th June 2022
Course Code	**:** ECE 213	**Time**	**:** 09.30 am to 12.30 pm
Course Name	**:** DIGITAL SIGNALPROCESSING	**Max Marks**	**:** 100
Program & Sem	**:** BTech (EEE) & VI Sem	**Weightage**	**:** 50%

Instructions:

(iii) ***Read the question carefully and answer all the questions***

(iv) ***Scientific non-memory calculator permitted***

Part A [Memory Recall Questions]

Answer the following question. Each question carriesTWO mark. **(15Qx2M=30M)**

Q.NO.1 Answer the following question.

(i) As compared to analog systems, digital signal processing allows 1). More reliability 2) Flexibility in the system design. 3) Cheaper systems. 4). Programmable operations. Identify the statements truthfulness. (C.O.No.1)[Knowledge]

a) 1, 2 and 3 are correct
c) 1, 2 and 4 are correct
b) 1 and 2 are correct
d) All the four are correct

(ii) The signal transformation is a mathematical method for transforming time-domain representation to frequency-domain representations. Identify the purpose of signal transformation? (C.O.No.1)[Knowledge]

a) Analysis b) Quantization c) Sampling d) Modulation

(iii) In signal processing, the Overlap–add method is an alternate way to evaluate the convolution of a very long signal with a finite impulse. Here, For information processing, the amount of delay is_____ (C.O.No.1)[Knowledge]

(iv) A discrete-time signal with length 'L' and another discrete-time signal of length 'M' are linearly convolved and produces a discrete signal with a length of _____ (C.O.No.1)[Knowledge]

(v) The DFT can be used as an intermediate step in signal processing. x(n) is a real sequence and X(k) is its N-point DFT. The 8 point DFT of x(n) is, X(k)={28, (-4+9.656j), _____, (-4+1.656j), (-4), (-4-1.656j), (-4+4j), (-4-9.656j)} fill the blank value. (C.O.No.1)[Knowledge]

(vi) The Discrete Fourier transform of circular convolution of two sequences in time domain is equivalent to (C.O.No.1)[Knowledge]

a) Summation of DFTs of two sequences
b) Multiplication of DFTs of two sequences
c) Summation of IDFTs of two sequences
d) Multiplication of IDFTs of two sequences

(vii) If X1(k) and X2(k) are the N-point DFTs of x1(n) and x2(n) respectively, then the N-point DFT of [ax1(n)+bx2(n)] is _____ . (C.O.No.1)[Knowledge]

a) X1(ak)+X2(bk)
b) aX1(k)+bX2(k)
c) a[X1(k)+X2(k)]+b[X1(k)+X2(k)]
d) None

(viii) DIT algorithm divides the sequence into___ . (C.O.No.2)[Knowledge]

a) Positive and negative values
b) Upper higher and lower spectrum
c) Even and odd samples
d) Small and large samples

(ix) How many complex Additions are needed to compute N point DFT using direct formula? (C.O.No.2)[Knowledge]

a) N(N-1) b) N*N c) Nlog2N d) 2N

(x) IIR filters are realized in many forms. Which form of realization has minimum memory unit (Delay Unit)? (C.O.No.3)[Knowledge]

(xi) Parallel realization of filtering gaining importance for parallel processing of information. For parallel realization, the degree of the numerator must be less than the degree of the denominator. Check the following statement truthfulness. a) It is true statement b) It is false statement c) Depends on the Filter d) Hypothetical statement.

(xii) Through the observations of the equation we can decide that it is a recursive equation, which has ZEROS and POLES. From the above specification we can design a transfer function, which is perform the operations of _____ (C.O.No.3)[Knowledge]

a) Finite Impulse Response (FIR filter) c) FIR & IIR filter

b) Infinite Impulse Response (IIR filter) d) None of the above

(xiii) Which of the following elements are used in the realization of a system?

a) Delay b) Adders c) Multipliers d) All the above (C.O.No.3)[Knowledge]

(xiv) The Analog filter is described by _____ (C.O.No.3)[Knowledge]

a) differential equation b) difference equation c) both A&B d) none of the above

(xv) A particular filter operated over a wide range of frequencies and able to pass the frequency greater than given cutoff frequency. Which is ___ (C.O.No.4)[Knowledge]

a) LPF b) HPF c) BPF d) BSP

Part B [Thought Provoking Questions]

Answer the following question. It carries TWENTY marks. (1Qx20M=20M)

Q.NO.2. x(n) ={1,2,3,4,5,6,7,8} where n varies from (-2) to (5).It mean that x(0)=3; This sequences are considered as a discrete input signal to a system which produce the output by delaying the input by 2 unit time instant. That system output is considered as y(n). Find the DFT of y(n) by using DIF FFT algorithm. (C.O.No.2)[Application]

PART C(PROBLEM SOLVING QUESTION)

Answer all the following question. Each carries TEN marks. (5Qx10M=50M)

Q.NO.3. Using Impulse Invariant method find the transfer function in "z" domain from "s" domain when T= 0.2sec. Where $H(s)=10/(s^2+7s+10)$. (C.O.No.3)[Application]

Q.NO.4. Using bilinear transformation method, find the transfer function in z domain from s domain when T=1sec. Where H(s)=2/((s+1)(s+2)). (C.O.No.3)[Application]

Q.NO.5. Obtain Direct form I and II for the given difference equations y(n)+2y(n-1)+3y(n-2)=x(n)+5x(n-1) (C.O.No.3)[Application]

Q.NO.6. In analog Butterworth filter design procedure, the pass band attenuation is 2dB at a frequency of 20 rad/sec, similarly stop band attenuation is 10dB at a frequency of 30 rad/sec. Find the order of the filter and cutoff frequency from the given specification.

(C.O.No.3)[Application]

Q.NO.7. $H(z)=(1/2)+(1/3)z^{-1}+z^{-2}+(1/4)z^{-3}+z^{-4}+(1/3)z^{-5}+(1/2)z^{-6}$ identify and draw the suitable filter structure. (C.O.No.4)[Application]