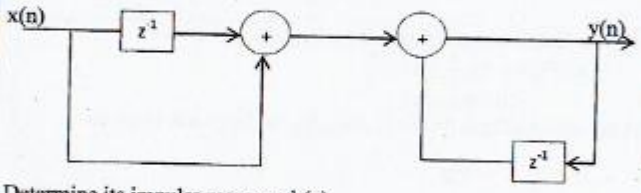
K. J. Somaiya College of Engineering, Mumbai-77
(Autonomous College Affiliated to University of Mumbai)

End Semester Exam
April - May 2018

Max. Marks: 100 | **Duration: 3hrs**
Class: TY-BTECH | Semester: VI
Name of the Course: Digital Signal Processing | Branch: EXTC
Course Code: UETC601

Instructions:
(1) All Questions are Compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Question No.		Max. Marks
Q 1 (a)	i. Determine auto-correlation sequences of the following signals a. $x(n)=\{\underset{\uparrow}{1},2,1,1\}$ b. $y(n)=\{1,\underset{\uparrow}{1},2,1\}$ ii. Consider the system shown in figure  Determine its impulse response h(n)	10 Marks
Q 1 (b)	Find the impulse response of an ideal lowpass filter with a linear phase response given by $H(e^{j\omega})=e^{-j\omega\alpha}$ $0\le\|\omega\|\le\omega_c$ $=0$ $\omega_c\le\|\omega\|\le\pi$	10 Marks
Q2 (a)	i. Find the inverse z-transform of $X(z)=\frac{z+0.2}{(z+0.5)(z-1)}$, $\|z\|>1$ ii. Find the z-transform of the following discrete time signal, and find ROC $x(n)=(-\frac{1}{5})^n u(n)+5\,(\frac{1}{2})^{-n} u(-n-1)$ OR, Obtain the direct form I, direct form II, cascade and parallel form realization for the system $y(n)=-0.1y(n-1)+0.2\,y(n-2)+3\,x(n)+3.6\,x(n-1)+0.6\,x(n-2)$	10 Marks

16/05/18 (E)

Q2 (b)	Compute IDFT 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} using DIF algorithm OR, An 8-point sequence is given by x(n)={2,2,2,2,1,1,1,1}.Compute 8-point DFT of x(n) by radix-2 DIT FFT	10 Marks
Q3 (a)	Determine and sketch the magnitude and phase response of the following systems $y(n)=\frac{1}{8}[x(n)+x(n-1)+x(n-2)+x(n-3)]$ OR, Use the DFT to compute the linear convolution of the signals $x_1=\{1,-1,1\}$; $x_2=\{2,2,1\}$	10 Marks
Q3 (b)	Consider an LTI system with impulse response $h(n)=(\frac{1}{3})^{\lvert n\rvert}$ Determine and sketch the magnitude and phase spectra for the input and output signals for the following inputs: i. $x(n)=\cos\frac{3\pi n}{8}$, $-\infty\le n\le\infty$ ii. $x(n)=\{\ldots,-1,1,-1,1,\underset{\uparrow}{-1},1,-1,1,-1,1,-1,1,\ldots\ldots\}$	10 Marks
Q4 (a)	Design an ideal bandpass filter with a frequency response $H(e^{j\omega})=1$ for $\frac{\pi}{4}\le\lvert\omega\rvert\le\frac{3\pi}{4}$ $=0$ otherwise Find the values of h(n) for N=11 and plot the frequency response . OR, Design a filter with $H(e^{j\omega})=e^{-j3\omega}$ $\frac{-\pi}{4}\le\omega\le\frac{\pi}{4}$ $=0$ $\frac{\pi}{4}<\lvert\omega\rvert<\pi$ Using a Hamming Window.	10 Marks
Q4 (b)	Design a Chebyshev low pass filter with the specifications α_p=1dB ripple in the pass band $0\le\omega\le0.2\ \pi$, α_s=15dB ripple in stop band $0.3\ \pi\le\omega\le\pi$ using bilinear transformation.	10 Marks
Q5 (a)	Answer Any two. i. What is the process of decimation in frequency spectrum? ii. What is sub-band coding of speech signal? iii. What is multi rate DSP? State one application in details. iv. How spectral analysis of stationary signal is done?	10 Marks
Q5 (b)	Explain multistage approach to sampling rate conversion.	10 Marks

25.05.2016

K. J. Somaiya College of Engineering, Mumbai-77
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End Semester Exam
April– May 2016

Max. Marks: 100 | **Duration: 3Hrs.**
Class: B.E.(Final) | Semester: **MU-CBGS-VII**
Name of the Course: Digital Signal Processing | Branch: Computer
Course Code: **UCEC701**

Instructions:
(1) All Questions are Compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Question No.		Max. Marks
Q 1 (a)	What is discrete time system? How discrete time systems are classified?	10
Q1 (b)	Sketch the following signals 1) u(-n+1) 2) u(-n-1)	5
Q 1 (c)	Find the cross correlation between given signals. $x(n) = \{1,2,3,4\}$, $y(n) = \{4,3,2,1\}$	5
Q2 (a)	Find the circular convolution of the following sequences $X1(n) = \{1,-1,2,-4\}$ and $X2(n) = \{1,2,0,0\}$	5
Q.2(b)	State whether the following systems are causal or not i. $y(n) = x(n) + 4\,x(n+1)$ ii. $y(n) = x(2n)$	5
Q2 (c)	Two discrete time LTI systems are connected in cascade. $h1(n) = (1/2)^n u(n)$ and $h2(n) = (1/4)^n u(n)$. Determine unit sample response of this connection. OR Find if following systems are causal & FIR or not 1) $h(n) = 4u(n+1) - 4u(n-2)$ 2) $y(n) - 0.8y(n-1) = x(n)$	10
Q3 (a)	Let $X(K) = \{1, -2, 1- j, 2j, 0, ----,----,----\}$ is the 8-point DFT of a real valued sequence x(n) 1) What is the 8-point DFT P(k) such that $p(n) = (-1)^n x(n)$ 2) What is the 8-point DFT Q(k) such that $q(n) = (-1)^{n-4} x(n-4)$ OR Find 8 – point DFT of following sequence using radix – 2 DIT – FFT algorithm $x(n) = \{1, 1, 1, 1, 0, 0, 0, 0\}$	10

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Q3 (b)	Given h(n)={1,2} Find the response of the system to the I/P x(n)={1,2,3} using FFT-IFFT	10
Q4 (a)	Find the output y (n) of a filter whose impulse response is h (n) = {2, 2, 1} and the input signal to the filter is x (n) = {3, 0, -2, 0, 2, 1, 0, -2, -1, 0} using overlap-add method. OR Explain radix-2 DIT-FFT algorithm.	10
Q4 (b)	Explain spectral analysis using FFT	5
Q4 (c)	Explain carls' correlation coefficient with example.	5
Q5	Write short note on (any two) 1) Energy and Power signal 2) DSP processor (TMS320C54X) 3) Any two applications of DSP	20

Q3	a) Design the second order Low Pass Digital Butterworth Filter whose cut off frequency is 1 KHz at sampling frequency 10^4 samples per second. Use BLT method.	10
	b) Use the Bilinear Transformation to design a Discrete Time Chebyshev High Pass filter with an equiripple passband with the following specifications $A_p = 0.9151\ dB \quad A_s = 20\ dB$ $\omega_p = 0.3\pi\ \omega_s = 0.1\pi \quad F_s = 1\ kHz$	10
	OR	
	a) Determine impulse response of linear phase FIR filter of length M=4 with $H(w) = 1\ at\ w = 0$ and $H(w) = 0.5\ at\ w = \pi/2$	10
	b) The desired frequency response of a low pass filter is $$H_d(e^{jw}) = \begin{cases} e^{-3jw} & -3\pi/4 \le \omega \le 3\pi/4 \\ 0 & otherwise \end{cases}$$ Determine $H(e^{jw})$ for M using Blackman window.	10
Q4 a)	i. Explain in detail different signal processing operations used in sub-band coding.	05
	ii. Explain VLIW Architecture of P-DSP	05
Q4 b)	i. Draw the schematic block diagram of TMS320C5X and explain the major blocks?	10
	OR	
	i. Explain the different addressing modes of TMS320C67XX DSP Processor	10
Q5	a) Explain dead band effect in finite precision arithmetic operation with the help of suitable example.	10
	b) In a recursive system the products are rounded to 4-bits including sign bit. The output round of noise power in direct form realization if the system function is $$H(Z) = \frac{1}{(1-0.35Z^{-1})(1-0.62Z^{-1})}$$ Assume the product range from -1 to 1.	10
	OR	
	b) Write short notes on Limit Cycle Oscillation due to quantization	10

Question No.		Marks
Q. 1	Attempt any Three. (All questions carry equal marks.) a) The transfer function of a system is given by $H(Z) = \frac{(2-Z^{-1})(1-Z^{-1})^2}{(1-2Z^{-1})(5-3Z^{-1}+2Z^{-2})}$ Realize the system in cascade structure. b) A digital filter is characterized by the following properties, i) It is high pass and has one pole and one zero. ii) The pole is at distance r =0.9 from the origin of Z plane. iii) Constant signals do not pass through the system. Find I) Pole zero pattern of the filter. II) System function H(z) III) Compute magnitude response of the filter IV) Normalize the frequency response H(ω) so that $\|H(\pi)\|=1$. V) Determine difference equation of the filter in time domain. c) Convert the high pass filter with system function $H(Z) = \frac{(1-Z^{-1})}{(1-aZ^{-1})}$, $a < 1$. into a Notch filter that rejects the frequency $\omega_0 = (\pi/4)$ and its harmonics, Find I) Difference equation of the notch filter. II) Sketch pole zero pattern of the notch filter. III) Sketch magnitude response of the both filters. d) Find and Sketch the autocorrelation function for $x(n) = \left(\frac{1}{2}\right)^n u(n)$. Also obtain the cross correlation of the sequences $x_1(n) = (2, 3, 4)$ and $x_2(n) = (1, 2, 3)$.	30
Q. 2	Attempt any Three. (All questions carry equal marks.) a) The impulse response of LTI system is h(n) = (1, 2, 2). Find output y(n) of the system for the input x(n) =(1, 2) using DTFT and DFT. b) Compute linear and circular convolution of the following sequences using DFT, x(n) = (1, 0.2, -1) and h(n) = (1, -1, 0.2)	30

	c) Compute 8 point DFT of discrete time signal $x(n) = (1, 2, 1, 2, 1, 3, 1, 3)$ using radix-2 DIF FFT. Also sketch magnitude spectrum. d) Find x(n) for given $X(k) = \{0.5, (2 + j), (3 + j), j, 3, -j, (3 - j2), (2 - j)\}$ by performing IFFT.	
Q. 3	Attempt any one. a) Design a Linear phase FIR high pass filter using Hamming window with a cut off frequency $\omega_c = 0.8\ \pi$ rad/sample and N =7. Also plot the magnitude response of the filter. N = Filter length b) Design a linear phase FIR low pass filter with cut off frequency of $0.5\ \pi$ rad/sample by taking 11 samples of ideal frequency response. Also plot the magnitude response of the filter.	15
Q. 4	Attempt any one. a) Design a Butterworth digital IIR high pass filter using bilinear transformation by taking T = 0.5 second to satisfy the following specifications. Pass band ripple ≤ 3.01 dB, Stop band attenuation ≥ 13.97 dB, Pass band edge frequency 0.65π rad/sample Stop band edge frequency 0.45π rad/sample. b) Design a Butterworth digital IIR low pass filter using impulse invariant transformation by taking T = 1 second to satisfy the following specifications. $0.8 \leq \lvert H(e^{jw}) \rvert \leq 1$ for $0 \leq w \leq 0.2\pi$ $\lvert H(e^{jw}) \rvert \leq 0.2$ for $0.32\pi \leq w \leq \pi$	15
Q. 5	Attempt any Five. (All questions carry equal marks.) a) What is multirate DSP system? b) What is decimation? c) What is interpolation? d) What are the advantages of multirate processing? e) Give any two applications of DSP. f) What is polyphase decomposition?	10

Apr –May 2017

Max. Marks: 100 | **Duration: 3 hrs**

Class: T.Y. B.Tech | Semester: VI

Name of the Course: Digital Signal and Image Processing | Branch: COMP

Course Code: **UCEC603**

Instructions:

(1) All Questions are Compulsory

(2) Draw neat diagrams

(3) Assume suitable data if necessary

Question No.		Marks
Q 1 (a)	Show that any arbitrary signal can be expressed as the sum of two signals, one of which is EVEN and other is ODD.	05
Q 1 (b)	Explain image fidelity criteria	05
Q 1 (c)	State whether following signals are periodic ,if yes then find their period i) Cos (0.2 π n) ii) sin(0.2 π n) + sin(0.18 π n)	05
Q 1 (d)	Prove that 2D DFT matrix is an unitary matrix.	05
Q2 (a)	Explain in details Enhancement techniques in spatial domain used for images.	10
Q2 (b)	Find DFT of given sequence using DITFFT algorithm X(n)={1,2,3,4,4,3,2,1}	10
	OR	
Q2 (b)	Explain edge linking using Hough Transform	10
Q3 (a)	i) Compute linear convolution of the following : X(n)={1,1,1,1} and h(n)={1,1,1,1} ↑ ↑ ii) Determine auto-correlation of the following signal x(n) = {1,3,1,1} ↑	10
Q3 (b)	Perform Histogram Equalization for the following and obtain original as well as equalized histogram	10

Intensity	0	1	2	3	4	5	6	7
Number of Pixels	70	100	40	60	0	80	10	40

OR

Q3 (b)	Explain i) Homomorphic filtering ii) Sampling and Quantization	10
Q4 (a)	Write a note on Discrete Cosine transform and its application in image processing.	10

Q4 (b) Determine the response of the given system for the given input sequence $x(n) = \{1, 0.5, 2\}$ & $h(n) = \{-1, 1\}$. (10)

OR

Q4 (b)	Find the Huffman code for the following stream of data (28 points) {1,1,1,1,1,1,1,2,2,2,2,2,2,3,3,3,3,4,4,4,4,5,5,5,6,6,7}	10
Q5 (a)	Explain the method of segmentation of images by Region splitting and merging	10
Q5 (b)	Explain various types of redundancies in image. Specify techniques to remove redundancies	10
	OR	
Q5 (b)	Write a short note on JPEG Compression	10

K. J. Somaiya College of Engineering, Mumbai-77
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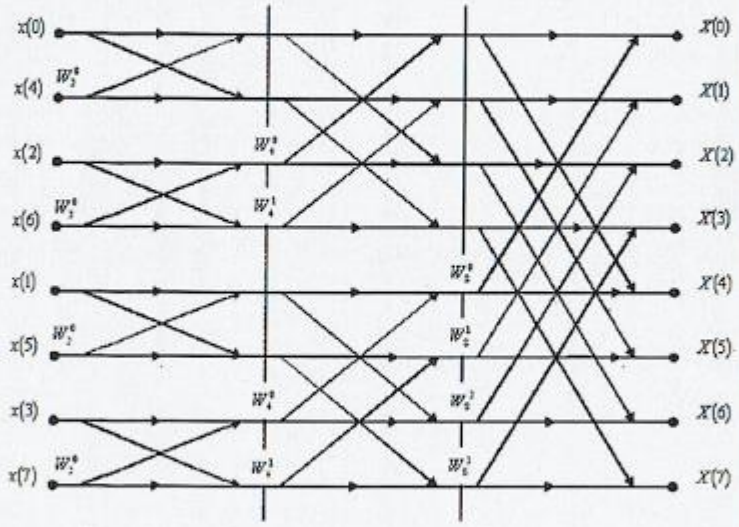
End Semester Exam
May-June 2019

Max. Marks: 100 | **Duration: 3hrs**
Class: TY-BTECH | Semester: VI
Name of the Course: Digital Signal Processing (SECTION A) | Branch: EXTC
Course Code: UETC601 | For PWD

Instructions:
(1) All Questions are Compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Question No.		Max. Marks
Q 1 (a)	Consider FIR filter $y(n)=x(n)+x(n-4)$ i. Calculate the values of magnitude response ii. Calculate the values of phase response iii. Compute its response to the input $x(n)=\cos\frac{\pi n}{2}+\cos\frac{\pi n}{4} \quad \infty<n<\infty$ iv. Calculate the values of magnitude response v. Calculate the values of phase response OR An FIR filter is described by the difference equation $y(n)=x(n)+x(n-10)$ i. Compute its magnitude response ii. Compute its phase response iii. Determine its response to the input $x(n)=\cos\frac{\pi n}{10}+3\sin\left(\frac{\pi n}{3}+\frac{\pi}{10}\right) \quad -\infty<n<\infty$	2*5 =10 marks
1 (b)	i. Perform linear convolution of finite duration sequences $h(n)=\{1,1,2,1\}$ and $x(n)=\{1,-1,1,2,1,0,1,-4,3,2,1,0,1,1\}$ by overlap-add method ii. Perform linear convolution of finite duration sequences $h(n)=\{1,1,2,1\}$ and $x(n)=\{1,-1,1,2,1,0,1,-4,3,2,1,0,1,1\}$ by overlap-save method OR i. Find Z-transform and ROC of the signal $x(n)=-b^n u(-n-1)$ ii. Determine z-transform and ROC of the finite duration signal $x(n)=\{2,4,5,7,0,1\}$ ↑	5 marks 5marks

Q2 (a)	i. Obtain direct I of LTI system governed by the equation: $y(n)= -\frac{3}{2}y(n-1)+\frac{3}{32}y(n-2)+\frac{1}{64}y(n-3)+x(n)+3x(n-1)+2x(n-2)$ ii. Obtain direct II realization of LTI system governed by the equation: $y(n)= -\frac{3}{2}y(n-1)+\frac{3}{32}y(n-2)+\frac{1}{64}y(n-3)+x(n)+3x(n-1)+2x(n-2)$	**5 marks** **5 marks**
Q2 (b)	i. Compute DFT of sequence x(n)={0,1,2,1} ii. Calculate values for magnitude response iii. Calculate values for phase response	**5 marks** **2marks** **3marks**
Q3	8 –point DFT of the given sequence x(n)={0,1,2,3,4,5,6,7}  i. Identify the type of algorithm ii. Arrange input in the order iii. Find out x(0),x(1),x(2),x(3),x(4),x(5),x(6),x(7),x(8) on output side	**1 Marks** **1 Marks** **1*8 Marks**

(Autonomous College Affiliated to University of Mumbai)

End Semester Examinations
May-June 2019

Max. Marks: 100 | **Duration: 3Hrs**
Class: T.Y. B.Tech | Semester: VI
Name of the Course: Digital signal and Image Processing | Branch: COMP
Course Code: UCEC603

Instructions:
(1) All Questions are Compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Question No.		Marks
Q 1 (a)	1) State the condition of stability of LTI system and determine for the given time system $h(n)= (0.3)^n u(n)+ 5\delta(n)$ is stable or not 2) For the given causal sequences $x(n)= \{8,9,2,3\}$ and $h(n)= \{4,3,6\}$. Find the cross correlation. OR Check whether following system $y(n) = 2x(n-1) + x(2n)$ is : 1. Linear or non-Linear 2. Causal or non-causal 3. Time variant or Time invariant 4. Static or Dynamic	10M
Q 1 (b)	Given 13 54 12 13 11 57 11 10 12 Find 3 bit IGS coded image and calculate compression factor ,BPP and MSE	10M
Q2 (a)	Perform histogram equalization and draw new equalized histogram of the following image data Grey Level: 0 1 2 3 4 5 6 7 No of Pixel: 70 100 40 80 60 40 8 2	10M

Q2 (b)	Find DCT of the given image using matrix multiplication method: 2 4 4 2 4 6 8 3 2 8 10 4 3 8 6 2	10M
Q3 (a)	Explain any five zero memory point operations.	10M
Q3 (b)	Write 8X8 Hadamard matrix and its signal flow graph. Using Butterfly diagram, compute Hadamard transform for X(n)={1,0,1,0,0,1,1,0}	10M
Q4 (a)	Explain Morphological operation Opening and Closing OR Explain 4, 8 and m connectivity of a pixel with examples	10M
Q4 (b)	Explain Hough transform with suitable example OR Explain in detail Moments , Normalised moments and central moments.	10M
Q5 (a)	What is image segmentation? Explain the following methods of image segmentation. 1) Region growing 2) Split and Merge OR What are different types of redundancies in digital image? Explain in detail giving example of each.	10M
Q5 (b)	Write short notes on (any two) 1) Homomorphic filter 2) Fidelity criteria 3) Haar Transform OR Explain : The first difference makes the chain code invariant to rotation	10M

(Autonomous College Affiliated to University of Mumbai)

End Semester Exam
MAY-JUNE 2021

Max. Marks: 50
Duration: 1 Hr. 45 Min.
Class: TY B.Tech Semester: VI
Name of the Course: **Digital Signal and Image Processing**
Branch: Computer
Course Code: **2UCC601**

Instructions:
(1) **All questions are compulsory**
(2) **Draw neat diagrams**
(3) **Assume suitable data if necessary**

Question No.		Max Marks
Q1 (A)	**State True or False (1 Mark each)** I. DCT is energy preserving Transform. II. Image segmentation does not depend on Illumination III. Image averaging can remove random noise. IV. Chain codes can be normalized. **Multiple Choice Questions (2 M each)** V. Given $x(n)=\sin((\pi/8)\, n^2)$ Find fundamental Period A) 18 samples B) 16 samples C) 10 samples D) 15 samples VI. Is the function $y[n] = x[n-1] - x[n-56]$ causal? A) The system is non causal B) The system is causal C) Both causal and non causal D) Anticausal VII. A pixel p at coordinates (x, y) has neighbors whose coordinates are given by: (x+1, y), (x-1, y), (x, y+1), (x, y-1) This set of pixels is called A) 4-neighbors of p B) Diagonal neighbors C) 8-neighbors D) M connectivity	10

<table>
<tr><td>Q1 (B)</td><td>Attempt any FIVE questions out of the following (any 5 out of 7)

I. Show that High pass= Original –Low Pass
II. Check whether y(n) = n x(n) is linear or non-linear.
III. Determine autocorrelation of the signal x(n)={1,2,1,1}
IV. Justify if the energy of the signal is finite its power is zero
V. Compute DFT of the given image using DIT-FFT:
<table><tr><td>0</td><td>1</td><td>2</td><td>1</td></tr><tr><td>1</td><td>2</td><td>3</td><td>2</td></tr><tr><td>2</td><td>3</td><td>4</td><td>3</td></tr><tr><td>1</td><td>2</td><td>3</td><td>2</td></tr></table>VI. Explain Fidelity criteria
VII. State any two properties of DFT.</td><td>10</td></tr>
<tr><td>Q2</td><td>Compare and contrast between the following(Any 2):

I. Lossless and Lossy Compression
II. Spatial domain and Frequency domain processing
III. Segmentation based on discontinuities and Similarities</td><td>10</td></tr>
<tr><td>Q 3</td><td>Generate Walsh Transform of given image
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<tr><td>Q4</td><td>What is Morphology. Explain the basic operations in Morphology.
OR
Find the Arithmetic Codeword of the message INDIA.</td><td>10</td></tr>
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K. J. Somaiya College of Engineering, Mumbai-77
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End Semester Exam
MAY-JUNE 2021

Max. Marks: 50
Duration: 1 Hr. 45 Min.
Class: TY B.Tech Semester: VI
Name of the Course: **Digital Signal and Image Processing**
Branch: Computer
Course Code: **2UCC601**

Instructions:
(1) **All questions are compulsory**
(2) **Draw neat diagrams**
(3) **Assume suitable data if necessary**

Question No.		Max Marks
Q1 (A)	**State True or False (1 Mark each)** I. DCT is energy preserving Transform. II. Image segmentation does not depend on Illumination III. Image averaging can remove random noise. IV. Chain codes can be normalized. **Multiple Choice Questions (2 M each)** V. Given $x(n)=\sin((\pi/8)\, n^2)$ Find fundamental Period A) 18 samples B) 16 samples C) 10 samples D) 15 samples VI. Is the function $y[n] = x[n-1] - x[n-56]$ causal? A) The system is non causal B) The system is causal C) Both causal and non causal D) Anticausal VII. A pixel p at coordinates (x, y) has neighbors whose coordinates are given by: (x+1, y), (x-1, y), (x, y+1), (x, y-1) This set of pixels is called A) 4-neighbors of p B) Diagonal neighbors C) 8-neighbors D) M connectivity	10

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<td>Q1 (B)</td>
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III. Determine autocorrelation of the signal x(n)={1,2,1,1}

IV. Justify if the energy of the signal is finite its power is zero

V. Compute DFT of the given image using DIT-FFT:

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VI. Explain Fidelity criteria
VII. State any two properties of DFT.</td>
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K. J. Somaiya College of Engineering, Mumbai-77
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End Semester Examinations
May-June 2022

Max. Marks: 100 **Duration: 3 Hours**
Class: TY Semester: VI
Name of the Course: Digital Signal and Image Processing
Branch: Computer Engineering
Course Code: 2UCC601

Instructions:
(1) **All Questions are Compulsory**
(2) **Draw neat diagrams**
(3) **Assume suitable data if necessary**

Question No.		Marks
Q 1 (a)	Classify the following DT systems on linearity, time invariance, causality i. $y(n)=x^2(n)$ ii. $y(n)=e^{x(n)}$ iii. $y(n)=4x(n)+ x(n-3)$	10
Q 1 (b)	i. What is Unitary transform matrix? Explain with example. ii. Explain in short sampling and quantization method for digital image.	10
Q2 (a)	Perform histogram equalization and draw new equalized histogram of the following image data	10
Q2 (b)	Explain the use of high pass filter mask and high boost filter mask for spatial domain enhancement.	10
Q3 (a)	Compute DFT of the digital image given below using DIT-FFT algorithm (DIT- FFT signal flow graph/ Butterfly diagram)	10

Gray Level	0	1	2	3	4	5	6	7
No. of pixels	700	1000	950	600	300	250	105	95

3	1	1	3
3	3	0	1
2	2	3	4
0	1	2	3

	OR Design 4 x 4 Haar transform matrix and represent the row basis functions (basis images) graphically.	
Q3 (b)	Write 8x8 Hadamard transform matrix and its signal flow graph. Using the Butterfly diagram, compute Hadamard transform for $x(n) = \{2, 3, 1, 3, 4, 3, 1, 1\}$	10 10
OR		
Q4 (a)	Apply Region Splitting algorithm for the given image and the predicate is $[\max\{f(x, y)\} - \min\{f(x, y)\} <= 4]$, where $(x, y) \in R$, where R is the given region. Show the quad Tree for the nodes. 7 3 6 7 6 7 5 5 5 5 4 4 6 4 8 7 6 4 5 4 7 6 8 6 7 5 5 4 6 3 4 6 4 4 4 5 4 5 5 6 3 3 4 6 6 4 4 8 3 4 3 3 5 4 4 5 5 5 4 3 7 6 5 4 OR What is image segmentation? Explain the following methods of image segmentation. i. Region growing ii. Split and Merge	10 10
Q4 (b)	Find variable length code using Huffman coding for the symbols and the data given below. Symbol | Probability a1 | 0.1 a2 | 0.2 a3 | 0.3 a4 | 0.14 a5 | 0.16 a6 | 0.1	10
Q5 (a)	Write a detail note on (any one) i. Hough Transform ii. Homomorphic filter	10
Q5 (b)	Explain in detail Hit or Miss Transform with an example	10

SOMAIYA VIDYAVIHAR UNIVERSITY

29·05·2024 (E)

Semester: January 2024 –April 2024 Maximum Marks: 100 Examination: ESE Examination – KT Duration:3 Hrs.		
Programme code:03 Programme: BTech. in EXTC Engg.	Class: TY	Semester: VI(SVU 2020)
Name of the Constituent College: K. J. Somaiya College of Engineering	Name of the department: EXTC	
Course Code: 116U03C503	Name of the Course: Digital Signal Processing	
Instructions: 1)Draw neat diagrams 2) All questions are compulsory 3) Assume suitable data wherever necessary		

Que. No.	Question	Max. Marks
Q1	Solve any **Four**	20
i)	What is Gibbs Phenomenon?	5
ii)	What is Region of convergence (ROC)?What is its significance ?	5
iii)	Describe the desirable characteristics of windows.	5
iv)	Find the inverse Z-transform of $X(z)=\frac{z}{(z-3)(z-4)}$ $\lvert z\rvert<3$	5
v)	Short note on Poly phase decomposition	5
vi)	What is pre- warping ?	5

Que. No.	Question	Max. Marks
Q2 A	Solve the following	10
i)	What are the differences and similarities between DIT and DIF FFT algorithm?	5
ii)	Explain the causes of finite word length effect in DSP.	5
	OR	
Q2 A	Obtain direct form II,cascade form realization for $y(n)= - 0.1y(n-1)+0.2y(n-2)+3x(n)+3.6x(n-1)+0.6x(n-2)$	10
Q 2 B	Solve any **One**	10
i)	Given $x(n)=2^n$ and N=8 ,find X(k) using DIT-FFT algorithm.	10
ii)	An FIR filter is described by the difference equation $y(n)=x(n)+x(n-10)$ a) Compute and sketch its magnitude and phase response b) Determine its response to the input $x(n)=\cos\frac{\pi n}{10}+3\sin(\frac{\pi n}{3}+\frac{\pi}{10})$ $-\infty<n<\infty$	10

Que. No.	Question	Max. Marks
Q3	Solve any **Two**	20
i)	Design a digital Butterworth filter satisfying the constraints $0.707\leq\lvert H(e^{j\omega})\rvert\leq 1$ for $0\leq\omega\leq\frac{\pi}{2}$ $\lvert H(e^{j\omega})\rvert\leq 0.2$ for $\frac{3\pi}{4}\leq\omega\leq\pi$ With T=1 sec using bilinear transform .Realize the filter using most convenient structure	10

ii)	Design a linear phase FIR bandpass filter to pass frequencies in the range 0.4π to 0.65π rad/sample by taking 7 samples of Hanning window sequence.	10
iii)	Determine the coefficients of a linear-phase FIR filter of length N=15 which has a symmetric unit sample response and a frequency response that satisfies the conditions $H(\frac{2\pi k}{15})=1$ for k=0,1,2,3 $=0.4$ for k=4 $=0$ for k=5,6,7	10

Que. No.	Question	Max. Marks
Q4	Solve any **Two**	**20**
i)	An analog signal contains frequencies upto 10kHz a) What range of sampling frequencies will allow exact reconstruction of this signal from its samples? b) Suppose this signal is sampled with a sampling frequency f_s=8kHz.State with explanation what will be the reconstructed signal corresponding to frequency component of 5 kHz	10
ii)	Determine the inverse z-transform of $X(z)=\frac{1}{1+0.5z^{-2}-1.5z^{-1}}$ When (a) ROC: $\|z\|>1$ (b) ROC: $\|z\|<0.5$ (c) ROC:$0.5<\|z\|<1$	10
iii)	Find the effect of coefficient quantization on pole locations of the given second order FIR system, when it is realized in direct and in cascade form . Assume a word length of 4 bits through truncation. $H(z)=1-0.9z^{-1}+0.2z^{-2}$	10

Que. No.	Question	Max. Marks
Q5	(Write notes / Short question type) on any **four**	**20**
i)	State and prove time shifting property of Z transform	5
ii)	What is zero padding? Why is it needed?	5
iii)	Write some advantages of multirate processing.	5
iv)	What is the reason that FIR filter is stable?	5
v)	Short note on Musical Sound Processing	5
vi)	Explain process of interpolation in frequency spectrum?	5

3) Assume suitable data wherever necessary

Que. No.	Question	Max. Marks
Q1	Solve any **Four**	20
i)	Determine whether the following signal is periodic or not: $x(n) = sin\frac{\pi}{8}n\text{^}2$	5
ii)	Given is a 3*3 image, plot its bit planes. 9 10 8 11 12 15 13 14 9	5
iii)	Explain in short different types of discrete time signals (any five).	5
iv)	Explain different mathematical operations on signals.	5
v)	Write a short note on digital negative.	5
vi)	Determine even and odd parts of the signal: $x(n) = \{2,-2,6,-2\}$ ↑	5

Que. No.	Question	Max. Marks
Q2 A	Test the following systems for time invariance:	**10**
i)	**y(n) = x(n) + x(n-1)**	05
ii)	**y(n) = 2nx(n)**	05
	OR	
Q2 A	Construct the block diagram and signal flow graph of the discrete time system whose input-output relations are described by following difference equation **y(n) = 0.4y(n-1)+x(n)-3x(n-2)**	10
Q 2 B	Solve	**10**
i)	An 8 point sequence is given by x(n) = {2,1,2,1,1,2,1,2}. Compute 8-point DFT of x (n) by radix-2 DIT-FFT.	10

Que. No.	Question	Max. Marks
Q3	Solve any **Two**	**20**
i)	Explain the following spatial enhancement techniques with suitable example	10

	and state one application of each. a) Contrast stretching b) Log Transformation	
ii)	Compute the discrete cosine transform (DCT) matrix for N = 4.	10
iii)	Explain Low-pass Filtering in Frequency Domain	10

Que. No.	Question	Max. Marks
Q4	Solve any **Two**	**20**
i)	Describe Canny Edge Detector in detail with an example.	10
ii)	Using Hough transform show that the following points are collinear. Also find the equation of the line for (x,y) plane are (1,2) ; (2,3) and (3,4).	10
iii)	Explain different Morphological operations with necessary equations.	10

Que. No.	Question	Max. Marks
Q5	(Write notes / ~~Short question type~~) on any **four**	**20**
i)	Run Length Encoding.	5
ii)	JPEG Compression	5
iii)	Hoteling Transform	5
iv)	Vector Quantization	5
v)	Region Split and Merge based segmentation	5
vi)	Image Moments	5

6·5·16 (m).

K. J. Somaiya College of Engineering, Mumbai-77
(Autonomous College Affiliated to University of Mumbai)
Semester: Jan-April 2016

Max. Marks: 100 **Duration: 3 Hrs**

End Semester Exam

Class: TE
Name of the Course: DSPP
Course Code: UEXC605

Semester: VI
Branch: Electronics Engineering

Instructions: All Questions are Compulsory

Question No.		Max. Marks
Q1	**Argue and Justify the following with examples (Any Four)** a) All the finite poles of FIR filter must lie at $z = 0$ b) An FIR Filter is always linear phase c) An FIR Filter is always stable. d) An Infinite Impulse Transformation is not suitable for the design of high pass filter. e) Butterworth and Chebyshev filters are always all poles.	20
Q2	a) A sequence is given as $x(n) = \{1, +2j, 1 + 3j, 2 + 4j, 2 + 2j\}$. from basic definition find $X(k)$. If $x_1(n) = \{1, 1, 2, 2\}$ and $x_2(n) = \{2, 3, 4, 2\}$, Find $X_1(k)$ and $X_2(k)$ by using DFT only once . b) Compute 4 point DFT of sequence $x(n) = \cos(\frac{n\pi}{2})$ using DIT-FFT Algorithm. **OR** b) $x_1[n] = \{2, 1, 2, 1\}$ and $x_2[n]] = \{1, 2, 3, 4\}$ perform the circular convolution of the above two sequence using Discrete Fourier Transform and Inverse Discrete Fourier Transform method i.e. property of DFT	10 10 10