Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058, India

(Autonomous College Affiliated to University of Mumbai)

MID Semester Examination

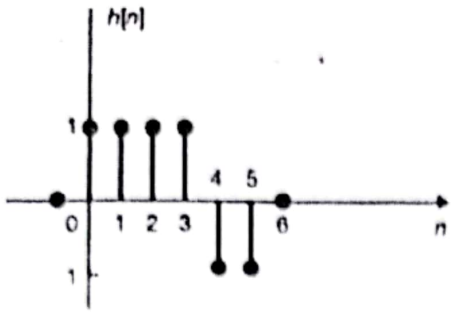
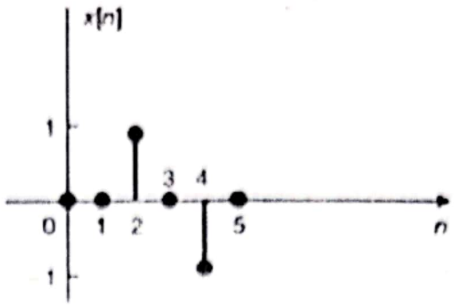
March 2024

Max. Marks: 30 | Duration: 60 Min
Class: TE Comp | Semester: VI
Course Code: CS307 | Branch: CE
Name of the Course: Fundamentals of Signal & Image Processing

Instruction:

(1) All questions are compulsory.
(2) Use of scientific calculators is allowed.
(3) Draw a neat diagram.
(4) Assume suitable data if necessary with justification.

		Max. Marks	CO
Q.1	Attempt the following Short Answer Questions.		
	a) Let $x(t) = 16 \sin(200\pi t) - 28 \cos(20\pi t)$ A discrete time (DT) signal is obtained by sampling x(t) with Sampling frequency Fs = 80 Hz. 1. What will be the frequencies in the resulting DT signal? 2. Determine whether the resulting DT Signal x[n] will be periodic. If periodic, what would be the period of x[n].	2	CO1
	b) Let x[n] be a DT signal and let $y_1[n] = x[2n]$, $y_2[n] = \begin{cases} x\left[\frac{n}{2}\right] & ; n \text{ is even} \\ 0 & ; n \text{ is odd} \end{cases}$ The signals y1[n] and y2[n] respectively represent the speeded up and slowed down versions of x[n]. For each of the following statements, determine whether it is true, if so, determine the relationship between the fundamental period of the two signals considered in each of the statements. [1] If x[n] is periodic, then $y_1[n]$ is periodic. [2] If $y_2[n]$ is periodic, then x[n] is periodic.	2	CO1
	c) A cascade of 3 LTI systems is causal and unstable. From this, can we conclude that at least one system is unstable and at least one system is causal.	2	CO1
	d) A signal v[n] is defined by $v[n] = \begin{cases} 1; & n = 1 \\ -1; & n = -1 \\ 0\,; n = 0 \text{ and } \lvert n \rvert > 1 \end{cases}$. What will be the value of the composite signal given by v[n] + v[-n] ?	2	CO1
	e) Let y[n] denote the convolution of h[n] and g[n], where $h[n] = (1/2)^n u[n]$ and g[n] is a causal sequence. If y[0] = 1 and y[1] = 1/2, then find the value of g[1] .	2	CO1
Q.2	The impulse response h[n] of a discrete-time LTI system is shown in Fig. (a). Determine and sketch the output y[n] of this system to the input x[n] shown in Fig. (b)	5	CO1

	 (a)  (b)		
Q.3	(a) State whether True or False. Image Enhancement process does not change the information content of the image. Justify. (b) Given an image of size (3 X 3) Determine the output image pixel value at g(1,2) using logarithmic Transformation $g(m,n) = 107 \log_{10}[1+ f(m,n)]$. $f(m,n) = \begin{bmatrix} 128 & 212 & 255 \\ 54 & 62 & 124 \\ 140 & 152 & 156 \end{bmatrix}$ (c) Given $F = \begin{bmatrix} 2 & 3 & 5 & 10 \\ 4 & 6 & 4 & 10 \\ 7 & 1 & 3 & 3 \end{bmatrix}$ Determine the output image pixel value A(1,3) using Power Law Transformation $S=(r)^2$. (d) Justify that the Median filter is the most suitable to remove Salt and Pepper Noise in monochrome image as compared to the Averaging filter.	8	CO2
Q.4	Obtain the gray level transformation function that stretches gray scale range [0, 100] into [0, 150] shifts range [100,150] to [150,200] and compresses the range [150,255] into [200,255]. [4 Marks]. Apply the above transformation function on the following image F and obtain the new image. [3Marks] $f(m,n) = \begin{bmatrix} 128 & 212 & 255 \\ 54 & 62 & 124 \\ 140 & 152 & 156 \end{bmatrix}$	7	CO2